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Award Number: DAMD17-99-2-9004

TITLE: Eglin Air Force Base Ecological Monitoring Program

PRINCIPAL INVESTIGATOR: Carolyn Kindell and Dr. Ann Johnson

CONTRACTING ORGANIZATION: Florida Natural Area Inventory
Tallahassee, Florida 32303-6273

REPORT DATE: June 2000

TYPE OF REPORT: Final

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	June 2000	Final (15 Nov 98 – 30 Jun 00)

4. TITLE AND SUBTITLE
Eglin Air Force Base Ecological Monitoring Program

5. FUNDING NUMBERS
DAMD17-99-2-9004

6. AUTHOR(S)
Carolyn Kindell and Dr. Ann Johnson

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Florida Natural Area Inventory
Tallahassee, Florida 32303-6273

E-MAIL:
CKINDELL@FNAI.ORG

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Report contains color graphics.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT ***(Maximum 200 Words)***

The Florida Natural Areas Inventory (FNAI) tested indicators of sandhill ecological condition, confirming the usefulness of some groundcover (graminoid, Solidago odora, woody vine, and legume density, and herbaceous cover) while discarding others (Hypericum gentianoides). The results highlighted the need for revision of Tier 1 sandhill criteria, and the features of groundcover that may be useful to do this. Further collection of groundcover data and the incorporation into a comprehensive sandhill monitoring program is recommended. Additional groundcover metrics were recommended for monitoring. A robust, base-wide sampling design was used.

FNAI narrowed the list of rare plant species on Eglin to 32 recommended for monitoring. These were classed into 8 priority groupings that should receive one of three basic levels of monitoring. Monitoring protocols for two rare species, Cladonia perforata and Matalea alabamensis were written. Baseline data for Cladonia perforata was collected.

Although most communities on Eglin will become conservation targets, prioritizing them is necessary in order to effectively implement a monitoring program. FNAI reviewed communities on Eglin, prioritized them according to rarity, importance to biodiversity, and degree of threat. FNAI selected eight communities that should receive high priority for monitoring and proposed preliminary metrics.

14. SUBJECT TERMS	15. NUMBER OF PAGES
sandhills, groundcover, herbaceous plants, ecological condition, rare plants, natural communities.	124
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACKNOWLEDGMENTS

The authors would like to thank the Eglin Natural Resources Branch for making possible FNAI's participation in their ecological monitoring efforts. Thanks are due to Rebecca Yahr for review of *Cladonia perforata* monitoring plan, and to Al Schotz, Terry Hogan and Linda Chafin for review of the rare plant section of this report. Dennis Teague provided logistical support in the initial *Cladonia perforata* monitoring effort. Milo Pyne provided support regarding review of TNC national classification plant associations for Eglin. Jamie Wojcik provided valuable GIS support. Howard Horne performed efficient, cheerful data collection and Brenda Herring provided valuable training in for the sandhill groundcover sampling. Deepest thanks are due to Louis Provencher, for his patient, expert advice on sampling design, the statistical analyses used in this report, and review of the sandhill groundcover portion of this report.

INTRODUCTION

The Natural Resource Branch of Eglin Air Force Base has established an ecological monitoring program to detect changes in ecological integrity on the base lands. The program goals are to detect emerging problems, verify management goals for restoration and maintenance of plant communities, identify stresses impacting the plant communities, and to study population changes of endangered and threatened plant species.

The Florida Natural Areas Inventory (FNAI) is Florida's Natural Heritage Program, established by the The Nature Conservancy (TNC) in 1971. FNAI's purpose is to collect, interpret, and disseminate ecological information critical to the conservation of Florida's biological diversity. FNAI maintains a statewide database on the status, distribution, and management of exemplary natural communities, geological features, rare plants, and rare animals. FNAI resources are used to facilitate environmentally sound planning and natural resource management that protects the plants, animals, and communities representing Florida's natural heritage. From 1993 to 1997 FNAI conducted field surveys of Eglin to identify high quality natural communities and to classify the landscape by Tiers of ecological condition (Kindell et al. 1997). FNAI also has conducted rare plant surveys (Chafin and Schotz. 1995), rare herpetofaunal surveys (Palis et al 1995, Printiss and Hipes 1999), and continues to work with Eglin on several projects related to natural resources inventory and management.

In November 1999 FNAI entered into an agreement with Eglin to provide general botanical and plant ecology expertise to the monitoring effort through provision of trained scientific staff. This position would help the Eglin team identify appropriate botanical data to collect, help design plant sampling methods and protocols, and conduct pilot sampling for some of these protocols. FNAI would help the team determine which plant communities and target plant species should be monitored.

FNAI staff met with Eglin natural resource managers and the ecological monitoring team in February 1999 to determine more specifically FNAI's tasks under this agreement. In that meeting is was agreed that the list of Ecological Integrity metrics in the report *Monitoring of ecological condition in a northwest Florida sandhill matrix ecosystem* (Hardesty *et al.*, 1997) was the basis for the monitoring program. The list of metrics was reviewed, and the groups of metrics for which FNAI was assigned to develop monitoring techniques were:

1. Sandhill groundcover. FNAI would re-assess three sets of metrics proposed by Hardesty, *et al.*: groundcover indicators of fire suppression and soil disturbance, graminoid cover and forb cover. FNAI would revise these metrics to incorporate new information, design sampling protocol and collect pilot data. (Task 1)

2. Rare plants. FNAI was to update and assess the list of rare plants on Eglin and determine which plants are highest priority for monitoring. FNAI would then select a

subset of these plants and design a sampling protocol for each, including setting up of data entry formats and report forms. (Task 2)

3. Natural communities. FNAI was to review the list of Eglin's natural communities, rank them according to priority for monitoring, and for a subset of communities, determine metrics important to monitoring community condition. FNAI would then design, and if time allows, conduct pilot monitoring on these communities. (Task 3).

4. Additional duties of FNAI were serving on the Ecological monitoring team for botanical and plant ecology issues, particularly related to interpretation and use of the Eglin landcover map. This included attendance at meetings and workshops when requested by Eglin staff, assistance to staff on plant identification, monitoring designs, and natural community management. (Task 4).

TASK 1: SANDHILL GROUNDCOVER VEGETATION METRICS

Introduction

Hardesty, *et al.* proposed three sets of sandhill groundcover metrics to be used in the ecological monitoring program at Eglin: understory forb cover, understory graminoid cover, and soil disturbance and fire suppression sensitive plant species. Understory forb cover and understory graminiod cover were chosen as measures for overall habitat quality. *Vaccinium darrowii* was suggested as the indicator of soil disturbance, and three species, *Pityopsis graminifolia*, *Solidago odora*, and *Pteridium aquilinum* were proposed as indicators of fire suppression. These recommended metrics and indicators represented the best available information at the time, based upon research conducted by the TNC/University of Florida/Tall Timbers Longleaf Pine Restoration Project at Eglin, and based upon knowledge of the authors.

As part of the Eglin Monitoring effort, FNAI was assigned the tasks of reviewing and updating the proposed metrics based on more recent information from the Longleaf Pine Restoration Project, developing a sampling protocol, and collecting pilot data in 1999.

Methods

Review and revision of original metrics. FNAI met with Dr. Louis Provencher to assess the proposed sandhill groundcover metrics in light of two additional years of research from the Longleaf Pine Restoration Project (Provencher *et al.* 1999). Dr. Provencher provided a preliminary list of 20 groundcover species that were highly correlated with fire suppression and soil disturbance based on his project's most recent sandhill vegetation data. FNAI and TNC narrowed the list to 9 potential indicators for use in this year's pilot data collection (**Table 1**).

The list was narrowed based on the abundance of each species or taxa (infrequently occurring species were eliminated), those species or taxa that would require reasonable sample sizes (based on power analyses), and ease of identification in the field by staff with little botanical training. This final list of 9 indicators replaces the metrics originally proposed in Hardesty, *et al.*(1997) and are intended to provide measures of overall groundcover quality, levels of fire suppression, and levels of soil disturbance.

Original sampling design. In April FNAI and Dr. Provencher developed a sampling design for the 9 potential indicators across all Eglin sandhills (**Appendix A**). This design was fully randomized and entailed sampling vegetation in up to five hundred 1/4 section blocks randomly placed in sandhills across the reservation. FNAI worked with TNC's Drs. Doria Gordon and Provencher to create monitoring and sampling objectives for this pilot project, which were submitted to Eglin in April 1999 as part of the monitoring design (Appendix A).

Modification of Sampling Design and Objectives. During a meeting with Eglin land managers and the ecological monitoring team in August 1999 the original design was modified so that data collection was stratified by Tier level, as well as randomly across all Tiers. The final sampling design was determined by Drs. Joe DeVivo and Tim Christiansen of the Eglin monitoring team and Carolyn Kindell of FNAI.

The sampling objectives were loosened, reflecting the preliminary nature of this pilot sampling, and were limited to collecting pilot data to determine the variation of the proposed indicators across Eglin sandhills as a whole and by Tier. The data could also be used in the future to determine the sample sizes necessary to meet monitoring and sampling objectives to be specified by Eglin in the future, when staff were ready to integrate sandhill groundcover sampling into an overall vegetation data collection program (for example, a modification of FMIS). The FNAI pilot sampling would also help determine the time and effort needed for base-wide groundcover sampling.

The final sampling design was as follows. Data were collected from randomly selected 1/4 sections stratified within 5 groups: Tier classes I, II, II/III, III, and randomly across all tiers. The target number of 1/4 section samples for each Tier class was set at 32 and for the randomly across all tiers at 120, assuming full time data collection from August to mid-December, at 4 samples per day. **Figure 1** shows a map of the sample quarter sections by group. Because it was unlikely that the full set of data could be collected in that time the data were to be collected in 8 sampling cycles, each consisting of four random 1/4 section samples for each Tier class and 16 1/4 section samples randomly across all tiers. **Figure 2** shows an example of a set of quarter sections in a sampling cycle. This would ensure that relatively even numbers of samples per tier would be collected, should FNAI be unable to collect the full data set.

Table 1. Groundcover indicators chosen for pilot sampling. One sample = the average of four 0.5 m x 8.0m random sub-plots within a quarter section.

Condition measured	**Indicator**	**Sample size estimate From TNC Ll Pine Restoration Project. 20% detection limit**	**Notes of characteristics observed from Provencher, *et al.*. 1999 data.**
Fire suppression	Graminoid density	14	Increases with fire and soil disturbance.
	Solidago odora density	511	Increases with fire.
	Dichanthelium spp. Density	27	Increases with fire and soil disturbance. But redundant with graminoid measure
Soil Disturbance	Woody vines	57	Short-term responder to fire (decreases) but good for long term in distinguishing reference condition from treatment plots in long leaf pine project study.
	Legume density	91	Indicator of lack of soil disturbance - distinguishes reference conditions from treatment plots
	Vaccinium darrowii density	295	Indicator of lack of soil disturbance. Increases with time since disturbance in chronosequence study.
	Hypericum gentianoides density	281	Increases with soil disturbance.
General groundcover measures	Total herbaceous cover	Not known	General measure
	Total woody cover < 1m in height	Not known	General measure
	Total cover <1 m in height	Not known	General measure

Four 0.5 x 8 meter subplots were randomly placed within each quarter section, within the area covered by the target tier class. Field staff carried tier map information for each quarter section in the field to ensure data were collected within the appropriate mapped tier class. The locations of the subplots were determined by a random walk method and the number of points ending up in non-target community types were noted. In each subplot the field crew counted densities of *Solidago odora*, *Vaccinium darrowii*, *Hypericum gentianoides*, legumes, graminoids, and woody vines, and estimated cover of woody plants < 1m in height, herbs, and total vegetation cover. Cover was estimated in modified Braun-Blanquet cover classes. Detailed field sampling protocols for sandhill groundcover indicators are given in **Appendix B**.

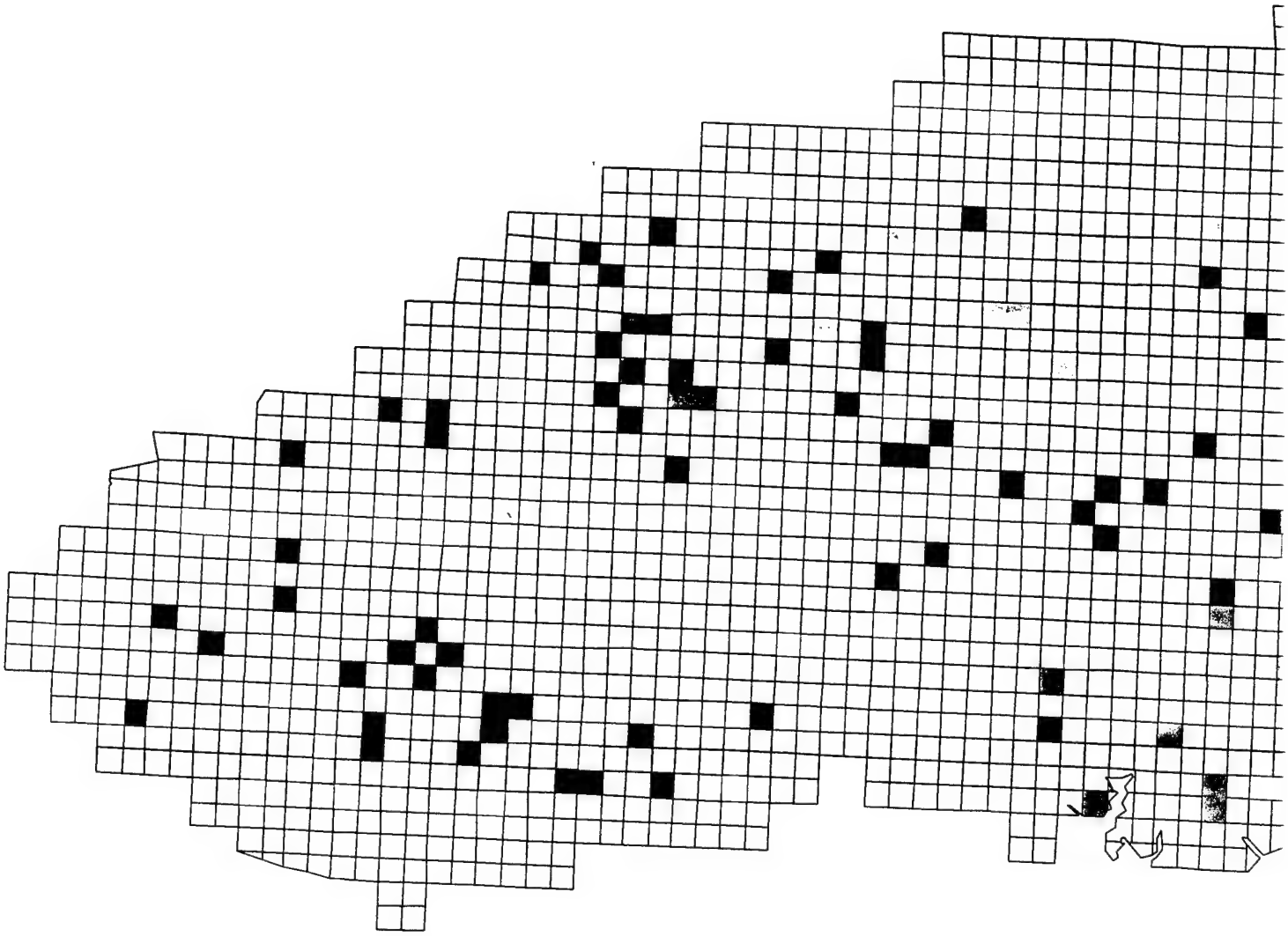
Data were collected using a Trimble Navigation GPS data logger. At least 20 real-time corrected locational data points were collected at each sampling point.

Data Management and Analysis. Every one to two weeks the raw field data were downloaded from the datalogger into Trimble Pathfinder Office 2.10 software, and exported to an Environmental Systems Research Institute (ESRI) ArcView 3.2 shape file. The locations of each subplot were reviewed to ensure the data were collected from the targeted quarter section and tier type.

To create the final data set, the raw data were exported from ArcView into a Microsoft Excel spreadsheet and, for each groundcover variable, data from the 4 subplots were averaged to get single value for the respective variables within each quarter section. This value was used in statistical analyses. FNAI provided the final data set to Dr. Tim Christiansen and Andrew Yost at Eglin in February 2000, and to Dr. Louis Provencher at TNC's Longleaf Pine Restoration Project in May 2000.

The statistical analyses presented in this report were performed by Dr. Provencher. To determine whether the suite of sandhill groundcover indicators allowed us to distinguish samples collected among different Tier groups, the stratified dataset was subjected to Discriminant Function Analysis (DFA) using the a priori sample design groupings Tier 1, 2, 2/3 and 3. DFA seeks to test that samples actually belong to the groups they were assigned to, thus providing a means to refine future grouping criteria and identify the indicators that most successfully explained the variability among groups. Because total cover was highly correlated with graminiod cover, total cover was removed for this analysis. Some variables were log-transformed prior to analysis in order to meet DFA assumptions of homogeneity of variance and normal distribution. Box plots for each groundcover variable by Tier group were created for the purpose of visual analysis of the data.

Figure 1. Sampling design for 1999 sandhill groundcover data c



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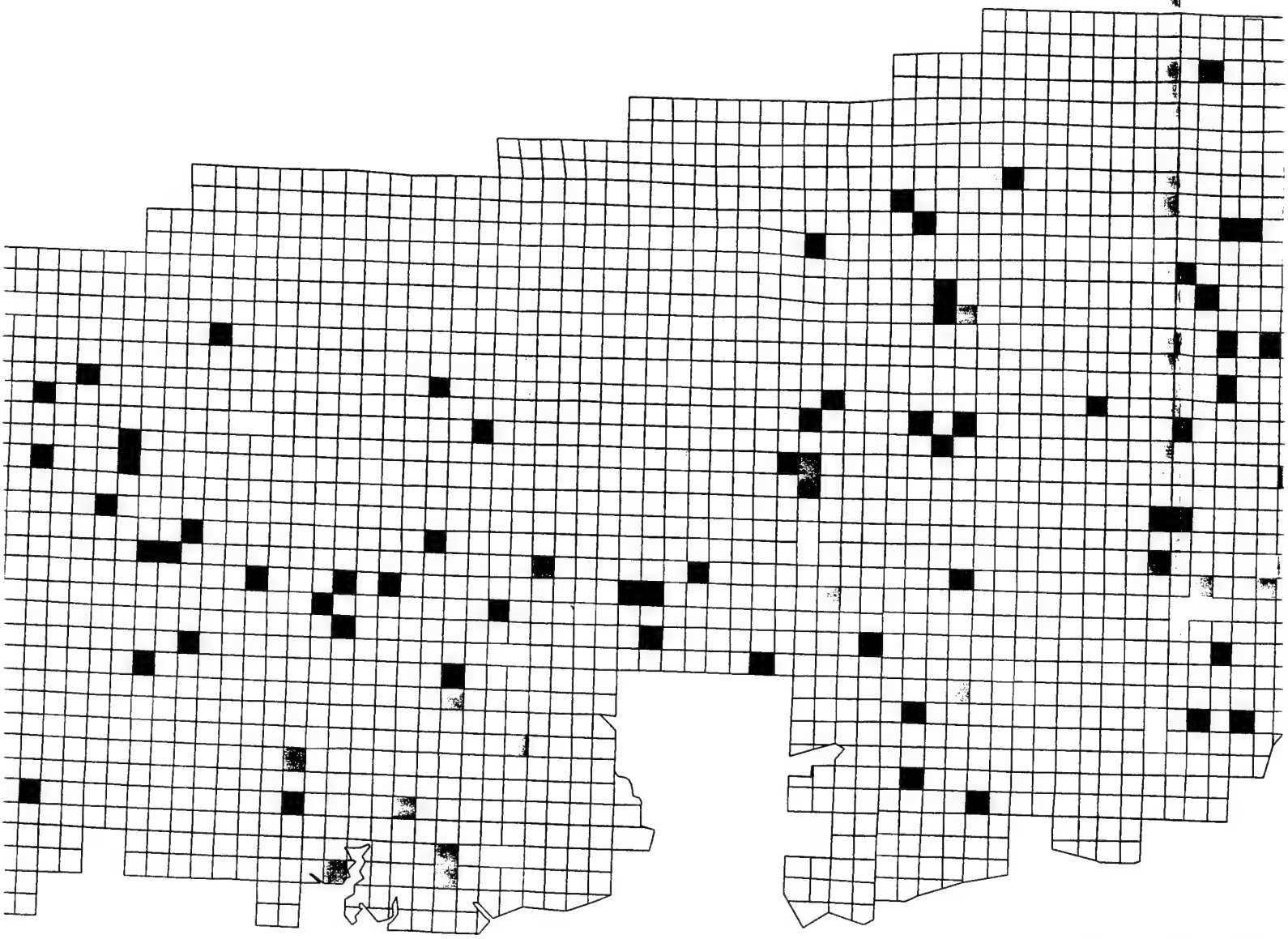
) sandhill groundcover data collection.



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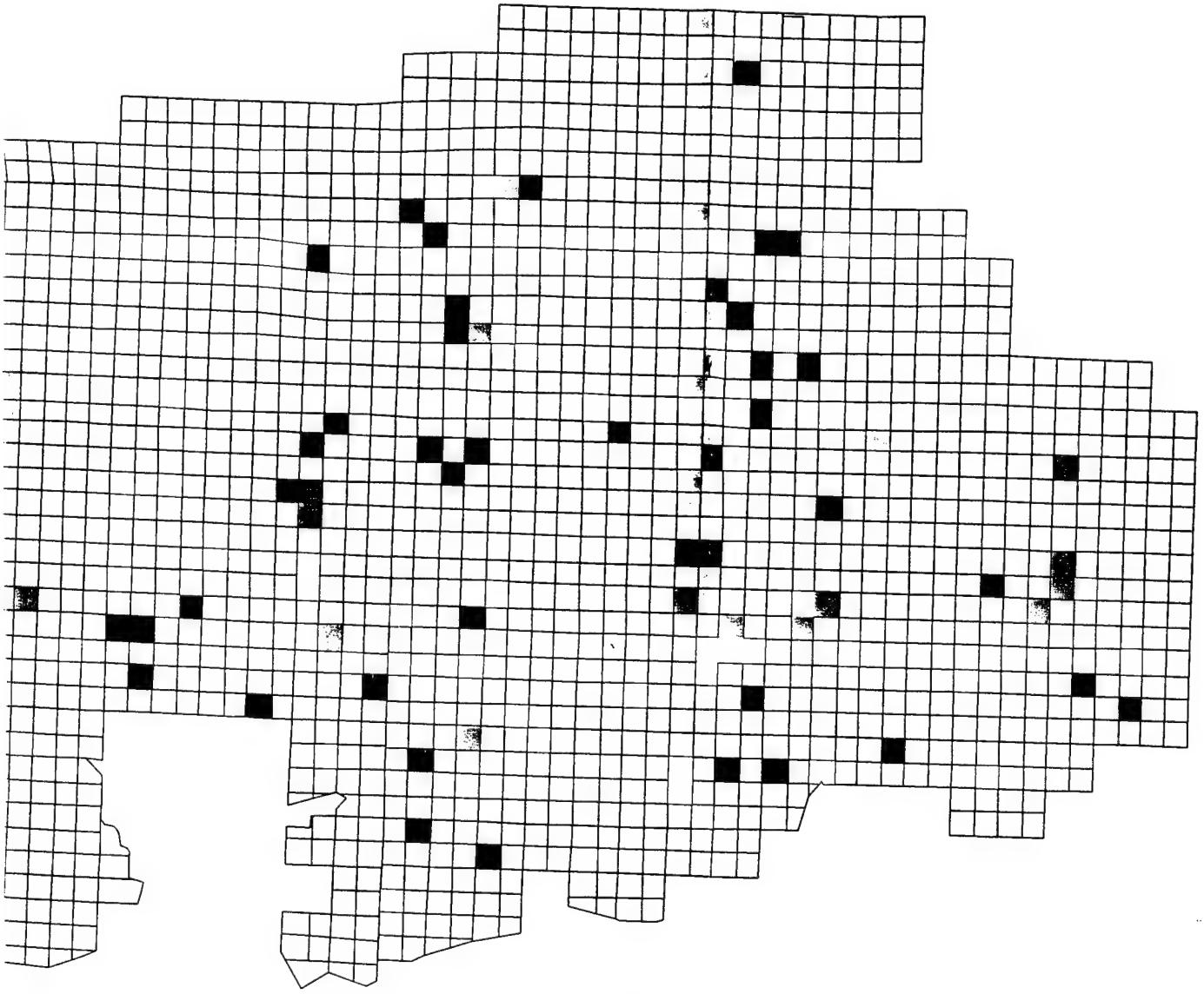

Legend

- Unstratified random
- Stratified random - Tier 1
- Stratified random - Tier 2
- Stratified random - Tier 2/3
- Stratified random - Tier 3
- Quarter section grid

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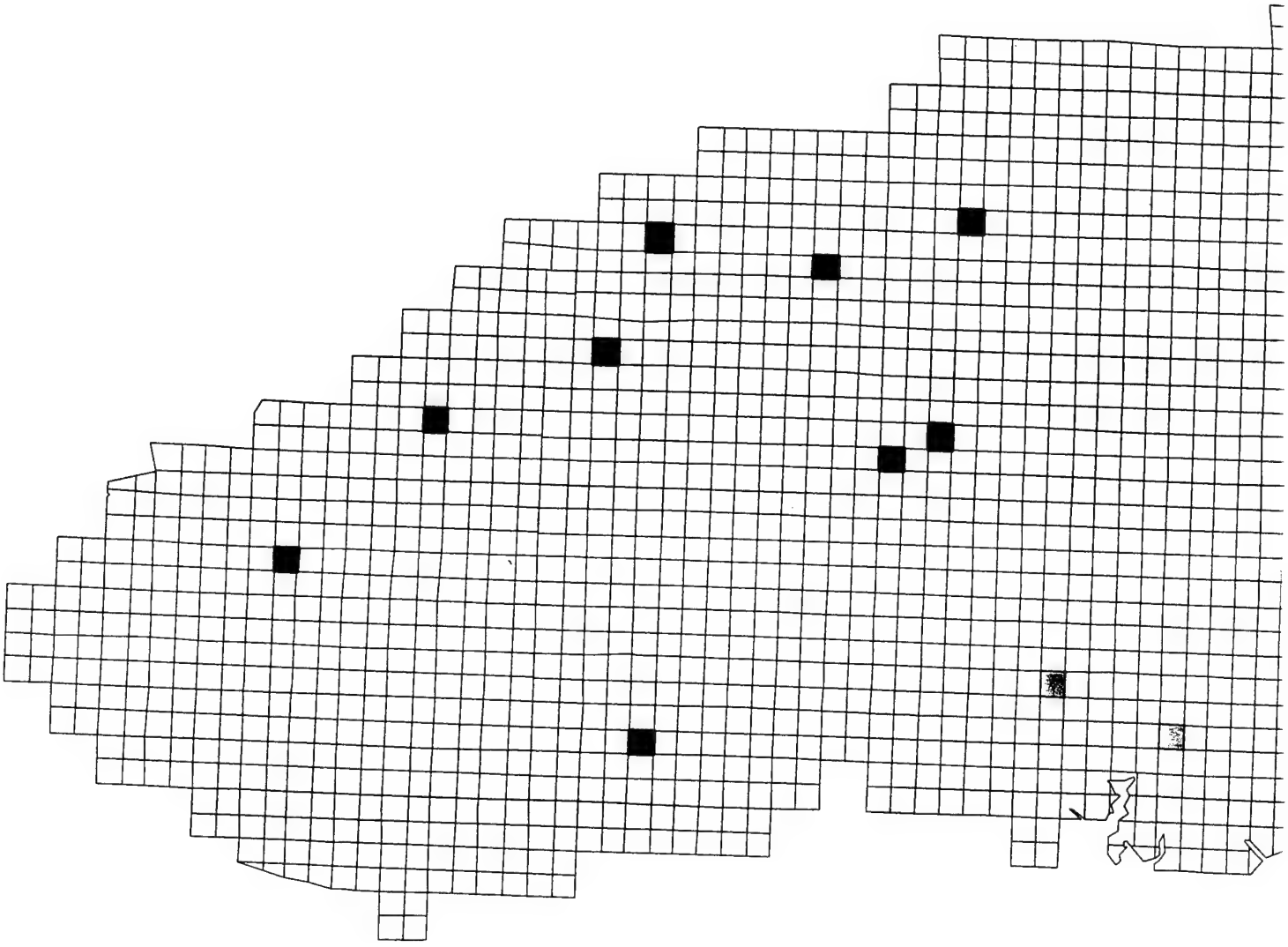
Figure 2. Example of random quarter sections in one 1999 sandhill gro



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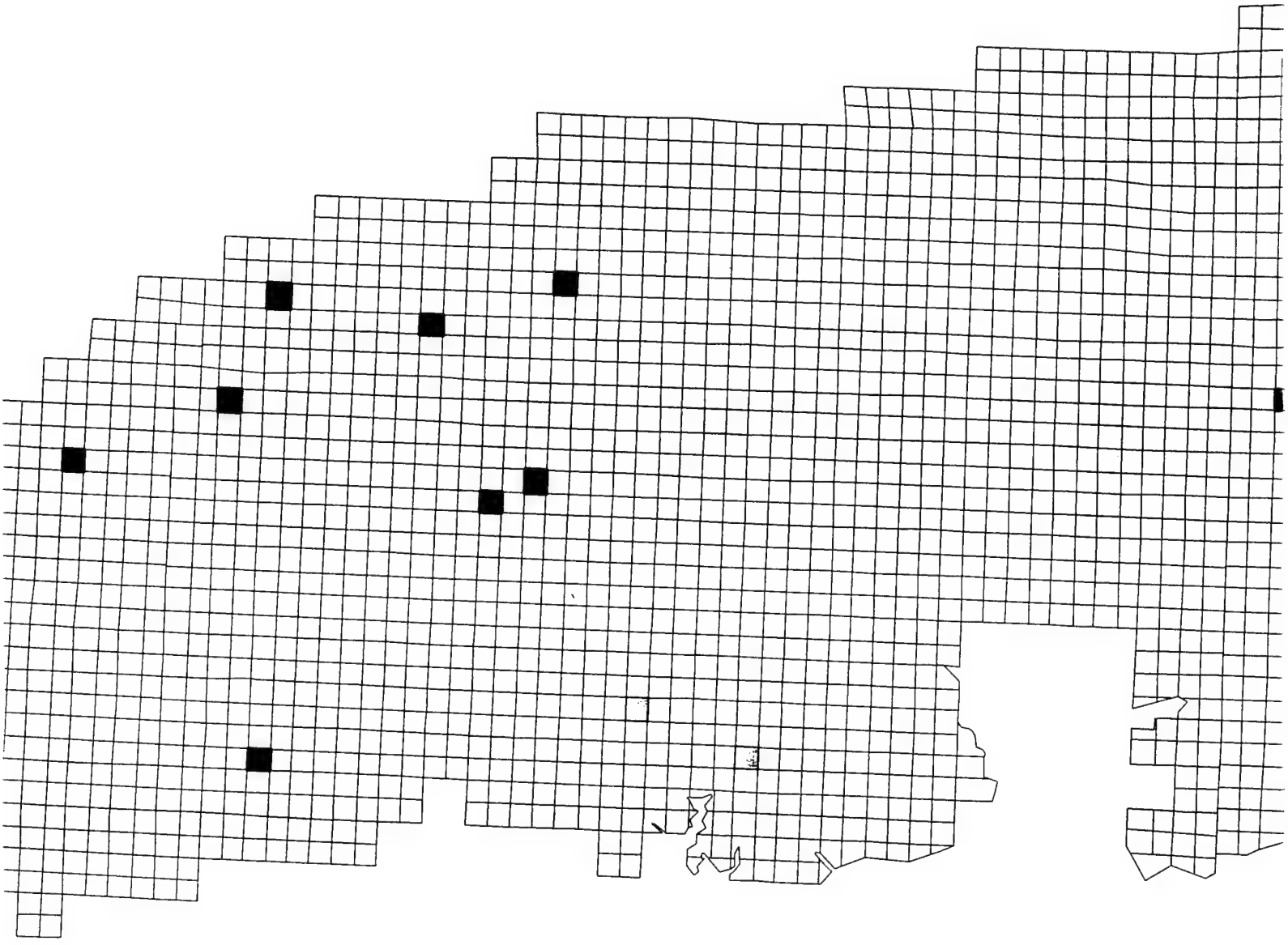
of random quarter sections in one 1999 sandhill groundcover sampling cycle.



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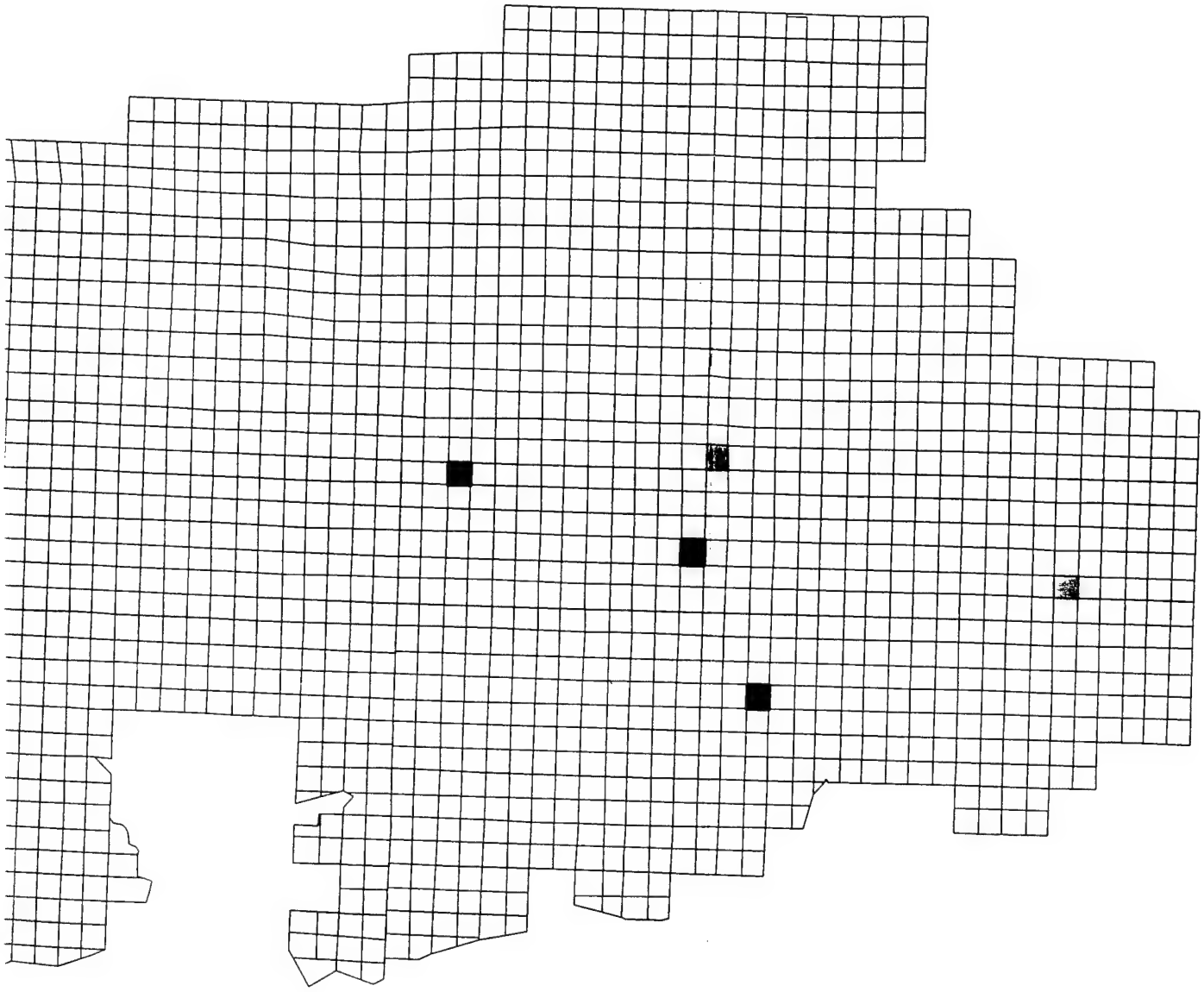
undcover sampling cycle.



Legend

- Unstratified random
- Stratified random - Tier 1
- Stratified random - Tier 2
- Stratified random - Tier 2/3
- Stratified random - Tier 3
- Quarter section grid

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Correspondence Analysis, Cluster Analysis, and Non-metric Multidimensional Scaling (NMS) were performed on the data collected randomly across all Tiers (fully randomized dataset). Correspondence Analysis was automatically performed on plots and indicators, while cluster analysis and NMS were conducted on plots only. DFA and Cluster Analysis were performed using Statistica ™ software for the Macintosh and the software Syntax ™ was used for NMS.

For the next analysis the data for all 174 samples (stratified and fully randomized) were combined and re-classified according to the following four groups: samples that fell within the boundaries of FNAI sandhll element occurrences (EOs), remaining samples in Tier 2, Tier2/3, and Tier 3 areas. The purpose of this re-classification was to allow graphical analysis of the data by these four groups. The FNAI sandhill element occurrences are areas recognized by FNAI as high quality sandhills, relative to all known sandhill occurrences in Florida (Kindell, *et al.* 1997). These element occurrences include all Tier 1 areas at Eglin and also include many higher quality Tier 2 areas. Thus the examination of the data using FNAI sandhill EOs as the highest quality grouping (instead of Tier 1), may help elucidate groundcover indicators that would be useful in distinquishing higher quality sandhills. For example, if the average value for an indicator within the sandhill EO group is significantly different from its average values within the other groups, then that indicator may be useful to include in a revision of the criteria for Tier 1 sandhills on Eglin.

Estimates of the sample sizes necessary for each for each variable were calculated. Means and standard deviations were calculated for each variable across all 174 samples. The sample size necessary to estimate the mean with a 80% level of confidence and a 20% level of precision was calculated using the appropriate formula in Elzinga, *et al.* (1998).

Results

A total of 174 quarter section samples were collected (**Figure 3**). Each quarter section was subsampled with four 0.5 x 8 meter quadrats randomly placed within the target tier map polygon area. The average of the four quadrats for each quarter section was the data used in analysis. The breakdown of quarter sections samples by tier is:

Sample Group	No. of quarter sections sampled
Tier I	24
Tier II	22
Tier II/III	20
Tier III	23
Random across all tiers	85
Total number of samples:	174

Seasonality of metrics. Certain metrics, such as *Hypericum gentianoides*, have a very short growing season. In June 1999, this species was just beginning to sprout, and was easily missed

in the plots due to its small size. By October 1, 1999, it was senescent, such that determining a living plant from previous year's dead was difficult in the field. Fall senescence was problematic for the woody cover (deciduous oaks), and legume density variables. These three indicators are not suitable for late-year sampling, and if future sampling includes these variables, then sampling should be restricted from early June to through September.

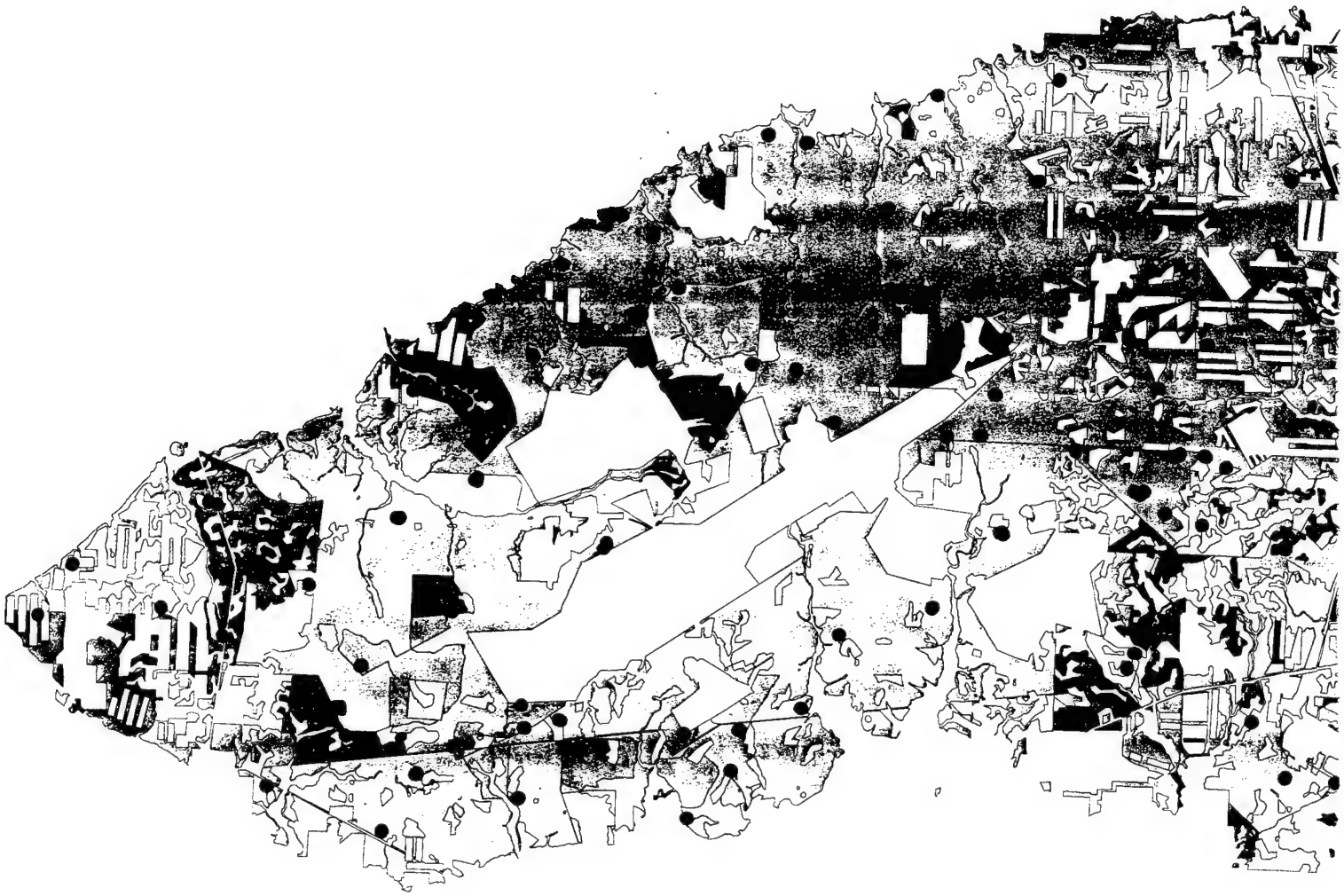
Sampling time estimate. On average, a single person with a four-wheel drive vehicle and Trimble data logger can complete four quarter sections per day. The highest number of quarter sections completed in a day was six. Data collection from the four randomly placed 0.5 X 8 m subplots takes between 0.75 and 1.5 hrs per quarter section, with travel time between quarter sections ranging from 0.15 to .75 hrs, depending on distance between sites and access difficulty. In any given day travel time among quarter sections, including time taken to locate sampling areas, was similar to, or greater than, time spent collecting data from the subplots.

Statisitical and graphical analyses. In the Discriminant Function Analysis (DFA) only moderate success was acheived in distinguishing Tier groups. **Table 2** shows the percent of observed samples correctly placed into predicted Tier groups (column 2). Tier 3 is consistently and clearly distinguishable from other tiers, using the present sandhill groundcover variables. The DFA showed an 80% correct classification of Tier 3 plots (Table 2), and it appeared as a separate group in the DFA root plot (Figure 4). Only 52 percent of Tier 2 samples correctly reclassified (Table 2). *Solidago odora*, herbaceous cover, and graminoid density were negatively correlated with, and provided the greatest contribution to, the root 1 axis (**Table 3**). These variables best explained the differentiation of Tier III from all others. Woody vine density, legume density and woody cover provided the greatest contribution to the root 2 axis. Woody vines and woody cover are highly negatively correlated with root 2. Legumes were positively correlated with root 2 (Table 3). These three variables best explained the differentiation of Tiers 2 and 2/3 (Figure 4).

Figure 4 plots the samples within Tier groups along roots 1 and 2. Tier 2/3 and Tier 3 samples form two relatively distinct clusters. Samples within Tier 1 and 2 groups exhibit only a slight separation along the root 1 axis with increasing graminiods, *Solidago odora*, and herbaceous cover. Tier 3 is most distinct, and negatively correlated with those variables on the root 1 axis. Tier 2/3 samples appear to mostly separate from the other tiers along the root 2 axis, with increasing woody vine density and woody cover. **Figure 5** shows a box plot of the data for each variable by Tier group. *Solidago odora* density, graminoid density, and herbaceous cover show a trend of decreasing values from Tier 1 to Tier 3, a visual confirmation of the importance of these in accounting for variation in root 1 of the DFA.

No clear groupings of the random, unstratified data subset were discernable using Correspondence analysis and Multi-Dimensional Scaling. Only weak groupings were found in a Cluster analysis, and these groupings did not change the interpretation of the DFA results presented above. For these reasons, the results from these analyses are not shown.

Figure 3. 1999 sandhill groundcover pilot data collection locations overlai



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dhill groundcover pilot data collection locations overlaid upon sandhill tiers

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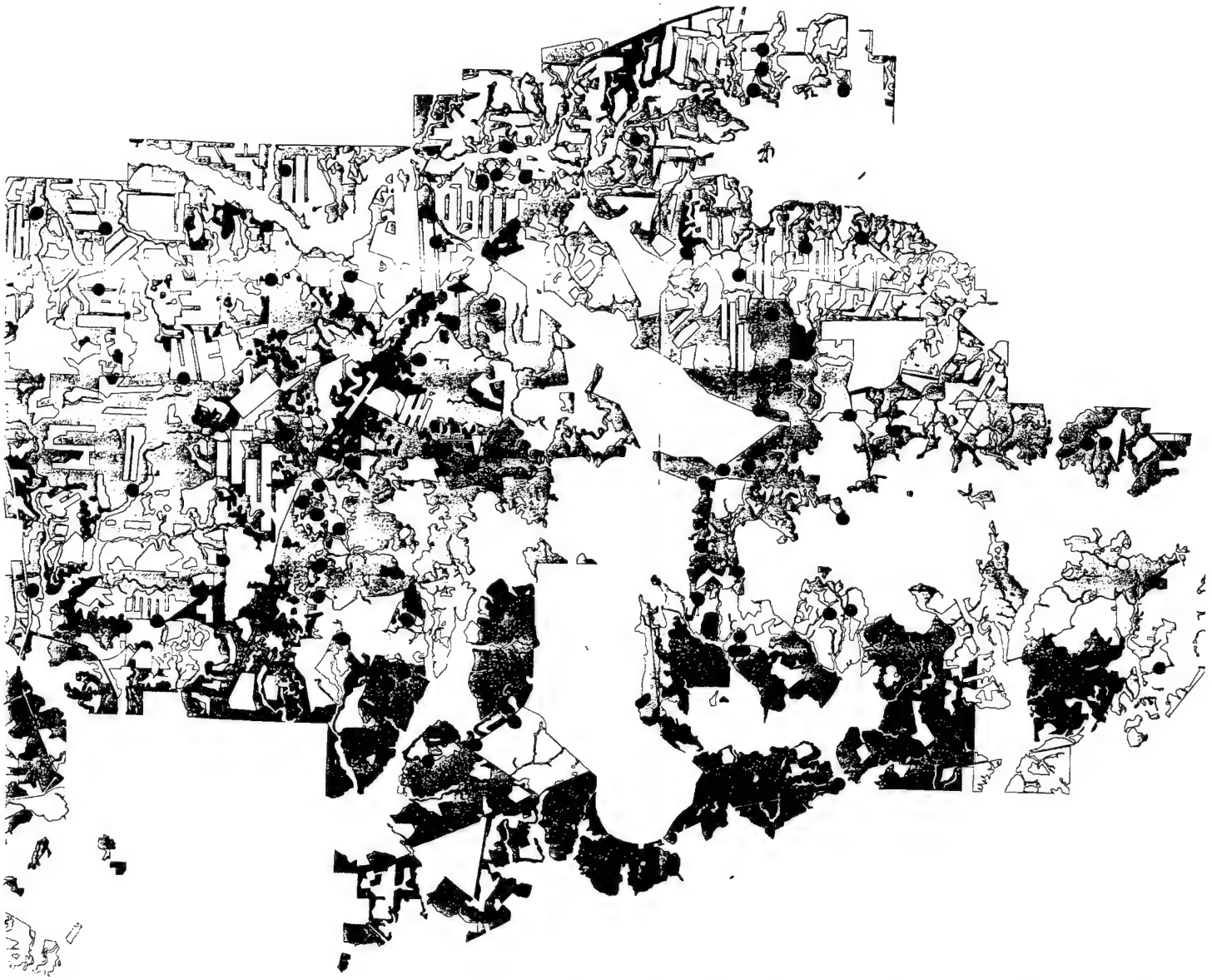

Legend

- Data collection location
- Tier 1 sandhills
- Tier 2 sandhills
- Tier 2/3 sandhills
- Tier 3 sandhills

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Table 2. Discriminant Function Analysis (DFA) classification matrix.

STATISTICA™ DISCRIMINANT STATS	Classification Matrix Rows: Observed classifications Columns: Predicted classifications				
	Percent	g_1:1	g_2:2	g_3:23	g_4:3
Group	**Correct**	p=.21348	p=.28090	p=.28090	p=.22472
g_1:1	**63**	12	4	3	0
g_2:2	**52**	7	13	3	2
g_3:23	**64**	3	3	16	3
g_4:3	**80**	0	2	2	16
--------	--------	--------	--------	--------	--------
Total	64	22	22	24	21

Table 3. Correlations of sandhill groundcover variables with DFA roots 1 and 2.

STATISTICA™ DISCRIM. STATS	Factor Structure Matrix Correlations Variables - Canonical Roots (Pooled-within-groups correlations)	
Variable	Root 1	Root 2
WOODY VINE DENSITY	0.182401	**-0.4959**
SOLIDAGO DENSITY	**-0.612394**	0.195152
LEGUME DENSITY	-0.314761	**0.312375**
HYPERICUM GENTIANOIDES DENSITY	-0.193624	0.045138
GRAMINOID DENISITY	**-0.882214**	-0.045465
VACCINIUM DARROWII DENSITY	-0.240309	-0.042939
HERBACEOUS COVER	**-0.783217**	**-0.350274**
WOODY COVER	-0.282938	-0.149498

Figure 4. Discriminant Function Analysis of stratified design (Tier 1, 2, 23, and 3).

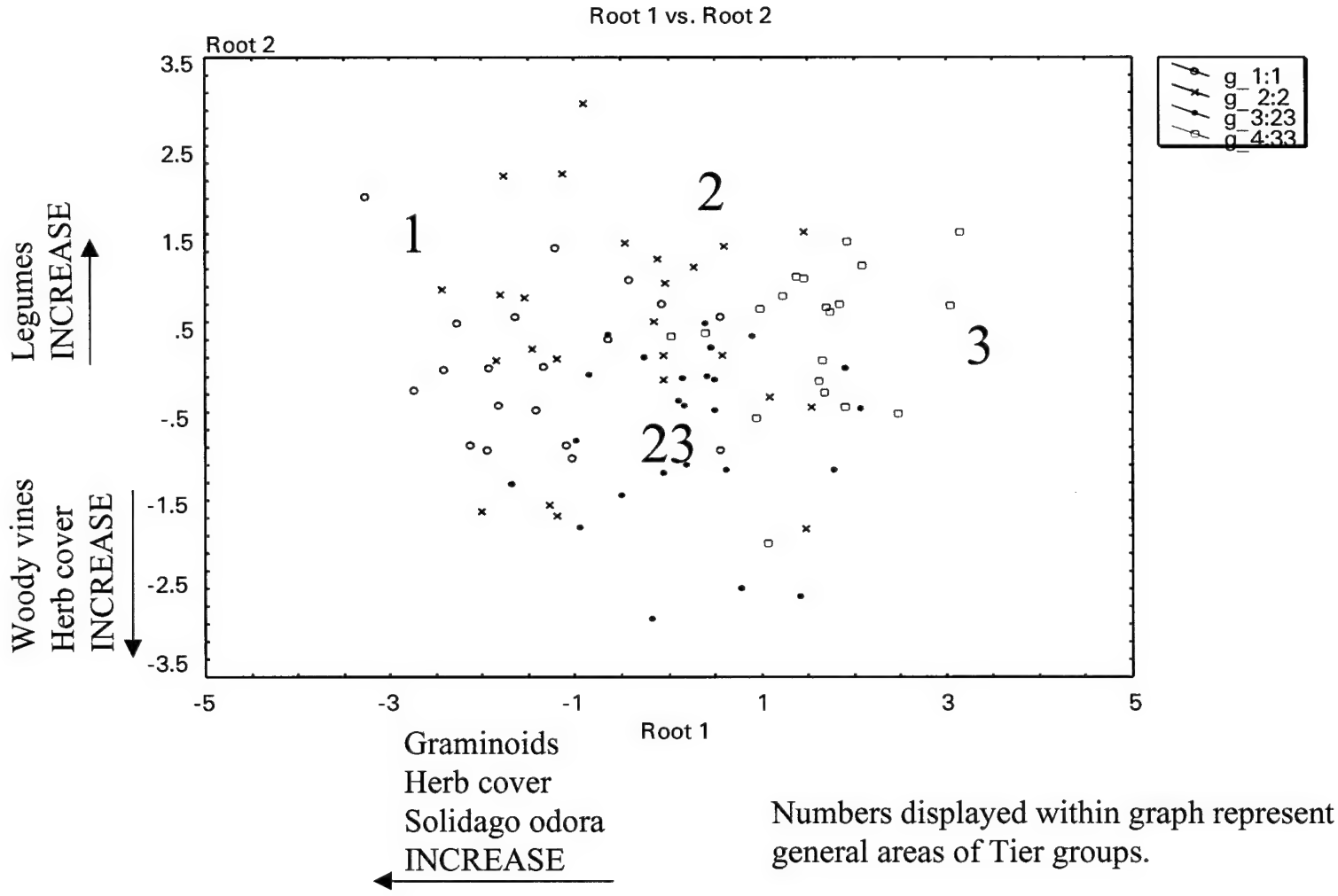
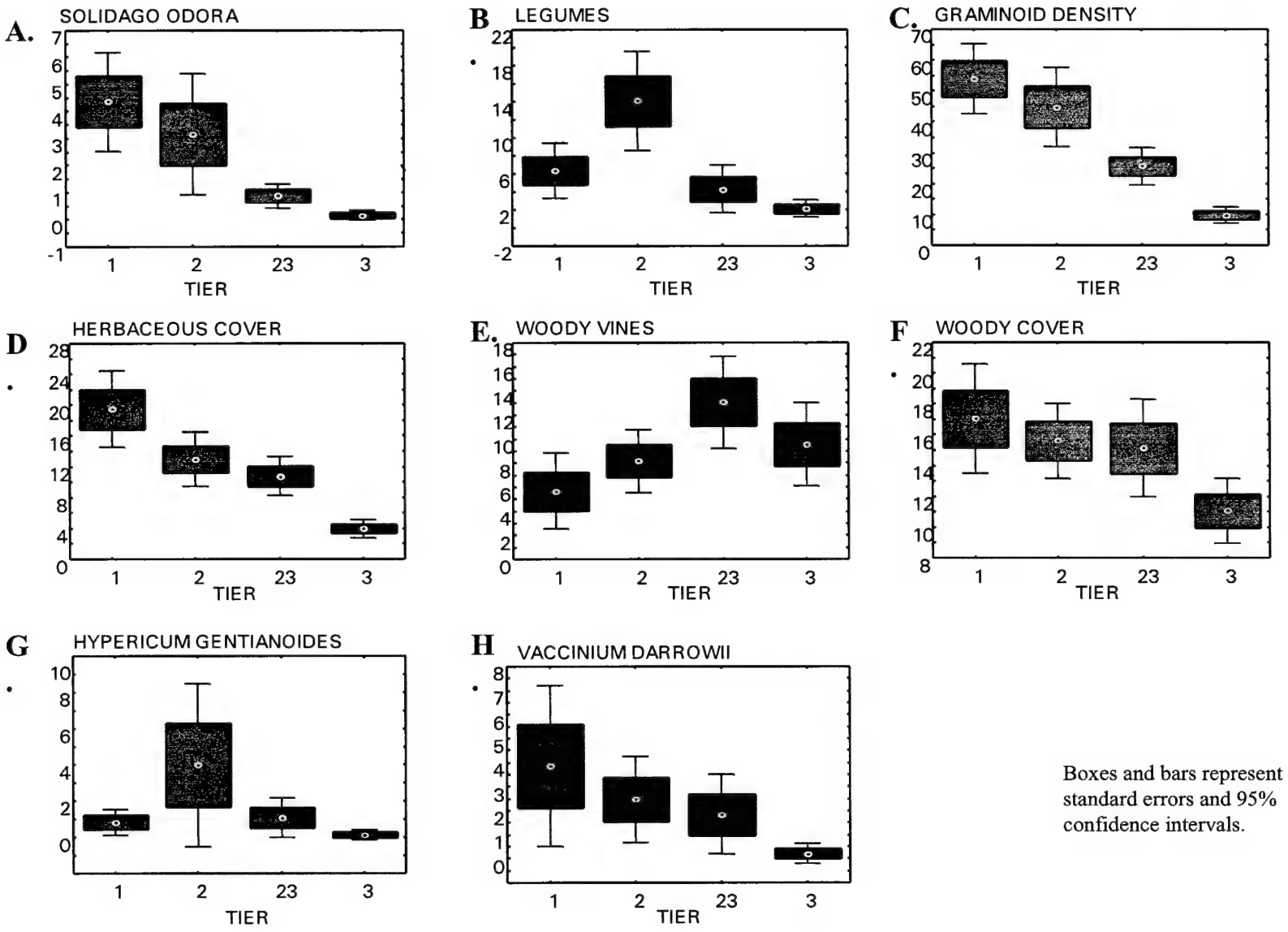


Figure 5. Box plots of sandhill groundcover indicators data grouped by Tier.



Boxes and bars represent standard errors and 95% confidence intervals.

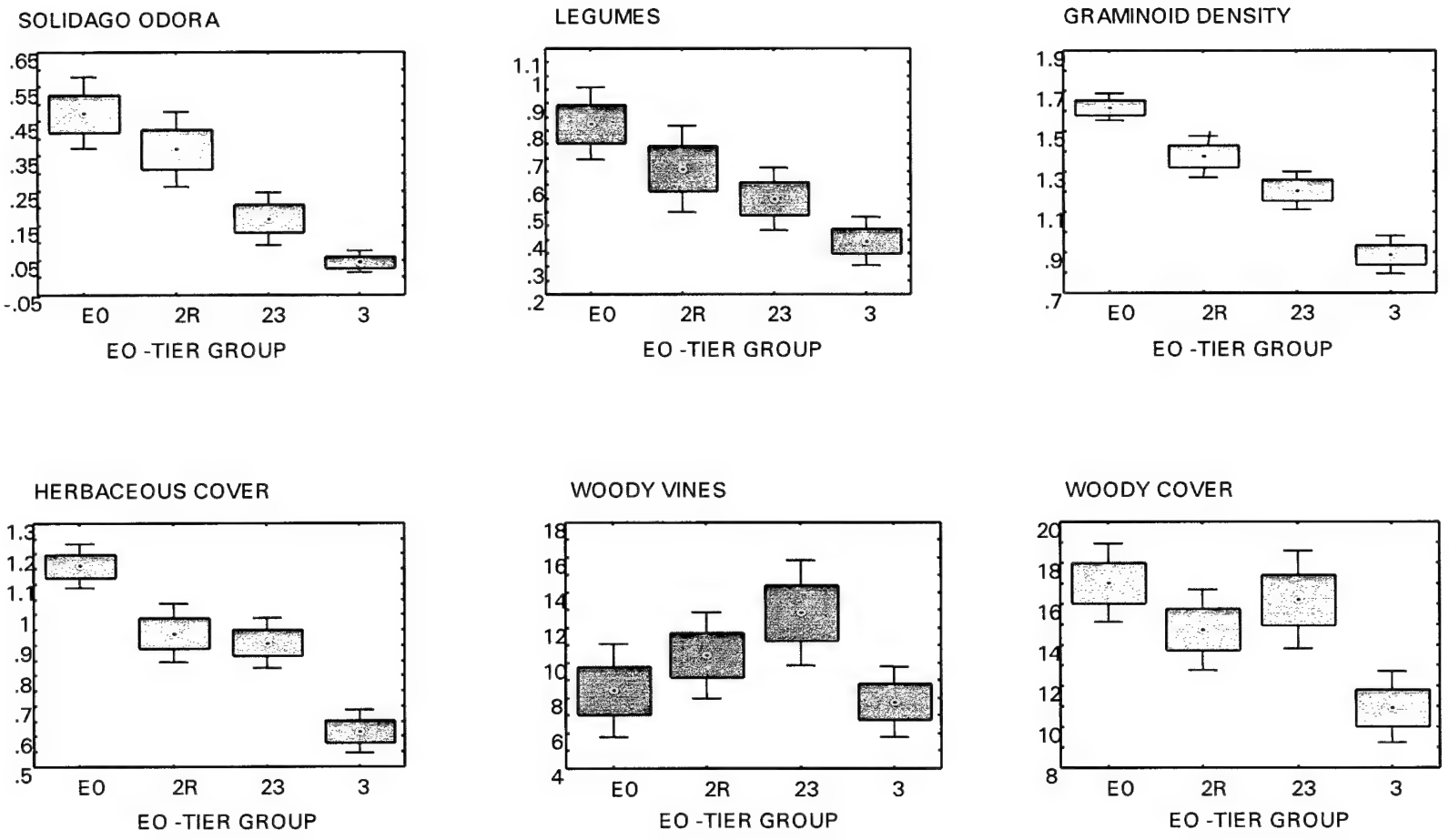
In order to determine whether the 1999 indicators could by useful in distinguishing between higher quality sandhills that may not be captured solely by the Tier 1 and Tier 2 groupings, we re-classified the data into four groups, using samples located within the boundaries of FNAI sandhill element occurrences (EOs) as the highest quality group. The sandhill EOs are areas recognized by FNAI as high quality sandhills, relative to all known sandhills in Florida (Kindell, *et al.* 1997). These EOs include all Tier 1 areas and also include many higher quality Tier 2 areas on Eglin. The examination of the data using sandhill EOs as the highest quality grouping instead of Tier 1, may help elucidate groundcover indicators that would be useful in distinguishing higher quality sandhill vegetation. **Figure 6** shows a box plot of the data for six variables grouped by the new classes: sandhill EO, remaining Tier2, Tier 2/3 and Tier 3. Graminoid density and herbaceous cover allow clear distinction between the EO group and Tier 2. Legumes and *Solidago odora* also show promise as indicators of these groups.

Sample sizes. Estimates of the sample sizes necessary for each variable are given in **Table 4**. Means and standard deviations were calculated for each variable across all 174 samples (and thus across all Tiers). These are sample sizes necessary to estimate the variable mean with a 80% level of confidence and a 20% level of precision (Elzinga, *et al.* 1998). Using a 95% confidence interval, required sample sizes would approximately double. Sample sizes were calculated across all Tier levels, encompassing the highest variation in the data. Thus samples sizes in Table 4 represent a high estimate. If calculated within Tier group, samples size would likely decrease per group.

Table 4. Mean, standard deviation, and estimated sample size of each sandhill groundcover variable, calculated using 1999 pilot data. Values were calculated across all sandhill samples (N = 174). Densities are based on 0.5 x 8 meter quadrat size.

Variable	mean	standard deviation	sample size
Solidago odora density	1.77	3.47	70
legume density	6.39	9.55	136
Hypericum gentianoides	1.38	5.01	172
graminoid density	27.42	24.35	200
Vaccinium darrowii density	2.24	6.06	156
woody vine density	9.87	8.87	80
herbaceous cover	9.99	8.73	77
woody cover	14.86	7.11	38

Figure 6. Box plots of sandhill indicators for all data, grouped by FNAI sandhill element occurrences and Tiers. The element occurrences (EO) contain all Tier 1 and many Tier 2 areas. The 2R group equals Tier 2 areas not within FNAI element occurrences.



Boxes and bars represent standard errors and 95% confidence intervals.

Discussion and Recommendations

Recommended sampling period. FNAI recommends a sampling period from mid-July to mid-October. TNC (product #3, memo May 17, 2000) recommended a sampling period ending in mid-November. *Tephrosia morhii*, an important component of the legume variable, drops its leaves by mid-October. *Pteridium aquilinum* (bracken fern), which can be a significant contributor to the herbaceous cover variable, is senescent by mid-October. Deciduous oaks are brown and drop leaves by early-to-mid November.

Time estimates. This project found an average sampling rate of four quarter section samples per day, for a single person who possessed detailed maps of the sampling locations. The largest number of samples collected in a day was six. The recommended sampling period of mid-July to mid-October equals 63 potential sampling days. Assuming seven of those days were unavailable for field work due to weather, military missions, etc, and a rate of four samples per day, a single person could collect a maximum of 224 quarter sections per year.

The Tier classification scheme. Tier 3 and Tier 2/3 vegetation can be readily distinguished from other tiers using the 1999 sandhill groundcover variables. Thus, over the Eglin landscape the percentage of the Tier 3 and 2/3 on Eglin could be estimated using the 1999 variables. Year to year comparisons, or comparisons to desired future condition levels of these tiers would then be possible to determine whether or not management objectives are being met.

Tier 1 and 2 classes were indistinguishable based upon the 1999 data. This may be due several possible factors: a lack of true difference among Tier 1 and 2 groundcover as they are presently defined; the failure of the1999 variables to indicate a true difference; or, too few samples to detect differences among the tiers. The first possibility is likely because Tiers 1 and 2 were originally distinguished based the dominance (>60%) of flat-topped, old growth longleaf pine in the canopy, and not by groundcover characteristics (Kindell et al 1997).

The data do point to possible way of revising Tier 1 criteria, however. Higher quality sandhills were distinguishable when FNAI element occurrences were substituted for Tier 1 as the highest level group. Graminoid density and herbaceous cover showed clear distinctions between the EO group and Tier 2, and. legumes and *Solidago odora* showed promise. These variables may help us pull out features of higher quality sandhills not presently captured by existing Tier 1 criteria.

Data analysis failed to detect any distinct groupings within Tier 2. FNAI recommends using other indicators, based upon management-oriented thresholds, for subdividing Tier 2. For example, some measure of mid-story oak abundance (density, cover or basal area) is suitable for subdividing Tier 2 according to mid-story abundance thresholds. These subdivisions could be areas that require immediate management action (e.g. fire application to reduce mid-story above a threshold value) in contrast to areas for which no action is required (where mid-story is below the threshold value).

Future monitoring - the need to integrate all sandhill vegetation monitoring. Any future monitoring of sandhill groundcover data should be integrated with a comprehensive vegetation data collection program that includes canopy, midstory and understory, components, and possibly abiotic factors that may be correlated with groundcover characteristics. It is essential, during this exploratory stage of the monitoring program, to collect data that will provide a more comprehensive view of variation across sandhill vegetation types, at all strata. Correlations among variables with different vegetation strata would eventually enable Eglin to reduce the number of sandhill vegetation variables necessary to estimate ecological condition and monitor management progress. To this end, FNAI recently learned of a proposed fire effects monitoring program being developed by the Fire Section at Jackson Guard. Although the details of the program are not know to FNAI at this time, based upon a verbal description of the program, given at a recent monitoring team meeting, this fire effects monitoring appears to be an appropriate place for future groundcover monitoring.

Suggested variables to measure in future. Woody vines, *Solidago odora*, graminoid, and legume densities, and herbaceous cover should be kept in future monitoring programs. The latter four show promise in allowing future revision of Tier 1 criteria. *Hypericum gentianoides* and total cover should be discarded. FNAI recommends keeping woody species cover (< 1m) for future monitoring, because it provides information about the community structure.

FNAI has reviewed the most recent group of sandhill groundcover variables proposed by the Longleaf Pine Restoration Project as indicators of fire suppression and soil disturbance (TNC memo re: product #3, May 17, 2000). Some minor modifications of those recommendation are offered here based upon the data presented in this report.

It should be noted that each of these variables should be reviewed carefully to ensure that they are not confounded with existing variables. For example, *Rhyncosia cytisoides* density will likely be confounded with legume density. Also, each variable should be carefully scrutinized to ensure that can be readily identified by field crew in vegetative form. Certain species, for example, *Scleria ciliata* and *Rhynchospora grayii* may prove quite challenging, requiring more time and effort than feasible.

Groundcover indicators recommended for inclusion in future sandhill ecological condition monitoring:

<u>Soil disturbance indicators</u>
Woody vines density
Legume density
Croton argyranthemus
Euphorbia floridana
Rhyncosia cytisoides
Andropogon virginicus

<u>Fire suppression indicators</u>
Graminoid density
Solidago odora density
Total herbaceous cover
Total woody cover
Rhynchospora grayii
Schizachyrium tenerum

In addition to keeping the useful 1999 variables and adding those recommended by the Longleaf Pine Restoration Project, FNAI recommends adding *Andropogon virginicus* density, and then calculating *A. virginicus* relative abundance against graminoid density. This measure would then be the indicator of soil disturbance. The Longleaf Project recommended against including this species as a variable because it responded positively to both soil disturbance (an undesirable condition in sandhills) and to mid-story reduction (a desirable condition in sandhills) in the Project's experiment. However, because some of the reference plots used in that study contain high amounts of *A. virginicus* that are apparently due to past soil disturbances, those reference plots may not represent true undisturbed habitat on Eglin. The Longleaf project's chronosequence studies indicate that *A. virginicus* levels decline with time since disturbance (May 17 memo). In FNAI's mapping criteria for each Tier level, the abundance of *A. virginicus* was noted as an indicator of past soil disturbance and it, along with other weedy species, were factored into the criteria to distinguish among Tiers (Kindell *et al.* 1997). Monitoring *A. virginicus* across the entire sandhill landscape on Eglin, through the ecological monitoring program, is recommended so that more data can be gathered to help resolve whether or not this species will be useful.

Future sandhill vegetation monitoring should be considered as further exploration into the usefulness of variables as indicators of ecological condition. It is doubtful, at least in the foreseeable future, that groundcover data alone will provide a complete set of indicators of sandhill ecological condition. Integration of all vegetation strata into a single, carefully designed monitoring program is necessary. It is imperative that Eglin have access to persons with a high degree of statistical and sampling design expertise, in order to successfully execute this large-scale program. Particularly during these early stages, the sandhill vegetation monitoring program will require creative data analysis and sampling design. Once a sampling design and final indicator variables are established, then statical analyses may become routine.

Summary

The 1999 sandhill groundcover monitoring is the first base-wide test of potential indicators of sandhill ecological condition. While results were mixed with respect to the use of groundcover data alone to determine sandhill Tier level, certain variables showed promise in this regard, and further data collection is recommended. This project confirmed the usefulness of some groundcover variables as indicators of ecological condition, while other variables clearly should be discarded. The pilot data collected under this project allowed measurements of indicator variability across all sandhills on Eglin enabling estimates sample sizes necessary for future monitoring efforts. Realistic time and effort estimates for groundcover sampling also resulted from this work. This project also illustrates a flexible, robust base-wide sampling design that may be applied as is, or in a modified form, to future sandhill vegetation monitoring.

TASK 2. RARE PLANTS.

Introduction

There are three major purposes of monitoring rare plant populations on Eglin. The first purpose is to detect population declines, both in terms of absolute number of individuals and in terms of the total number of sites occupied. Second, monitoring should focus on the specific threats to rare species that can be corrected through management actions, and allow managers to take action in time to stem decline before species or populations disappear or are irreversibly diminished. Third, once a management action is taken, monitoring should determine if the management actions taken were effective in halting the decline.

Hardesty *et al.* (1997) identified a metric for "ecoregionally significant plant species" to be monitored on Eglin. They proposed thirty species identified as rare or imperiled by FNAI for monitoring (i.e., ranked G1, G2, or G3). This list was revised based upon a more current list of rare species that are known to occur on Eglin. Prioritizing species to monitor, and narrowing the long list of rare species on Eglin to a subset of targets is perhaps the most important step in developing a rare plant monitoring program on Eglin.

FNAI updated and assessed the list of rare plants on Eglin, identified which species are highest priority for monitoring, narrowing the list to 32 target species. These 32 species were further prioritized for level of monitoring effort. FNAI then selected a few species for which monitoring plans were drafted. These monitoring plans include a brief synopsis of the natural history and management of the species, known locations, threats and management activities that can be taken to ameliorate the threats. Baseline field data were collected for one of the species.

Methods

The specific steps taken by FNAI to develop a monitoring plan for rare plants on Eglin were to:

1) Update and revise the 1995 rare plant list (Chafin and Schotz, 1995) according to latest FNAI information on rarity ranking by FNAI, state, and federal governments. Revise and incorporate information from the TNC target species list for the East Gulf Coastal Plain (Moranz and Hardesty, 1998);

2) Group and prioritize species on the revised list by FNAI rarity ranking, the percentage of total occurrences in Florida found on Eglin, and sensitivity to human or natural threats.

3) Determine the appropriate monitoring scheme for each group (presence /absence, abundance, number and distribution of sites monitored, frequency of monitoring).

4) Develop pilot monitoring plans for selected species. This includes setting up of data entry format and report form. (Time did not permit field testing and refinement of these pilot plans.)

Updating the list of rare plant species on Eglin. The metric for "ecoregionally significant plant species" described in Hardesty *et al.* 1997 suggests that the list of plants to be monitored on Eglin should be a subset of thirty species identified as rare or imperiled by FNAI (i.e., ranked G1, G2, or G3). Later, TNC proposed a list of 46 plant conservation targets for the Gulf Coastal Plain Ecosystem Partnership found on Eglin (Moranz and Hardesty 1998). That list omitted 12 species currently ranked G2, T2, or G3 by FNAI and included 4 that are not currently tracked by FNAI.

A rare plant survey of Eglin (Chafin and Schotz 1995) identified 60 taxa of rare plants on Eglin. Since that date, there have been some changes to the list of rare plants on Eglin. Three new rare plant species have been discovered on Eglin (*Hymenocallis henryae, Litsea aestivalis,* and *Pinguicula primuliflora*), five species have been removed from the FNAI tracking list due to a determination they are not as rare as previously thought (*Drosera intermedia, Illicium floridanum, Lilium catesbei, Peltandra sagittifolia,* and *Pinguicula planifolia*), and one species identification has been corrected (*Sideroxylon lycioides* to *S. thornei*). This brings the list of FNAI-tracked rare plant species on Eglin to 56 and the total list of all rare plants of conservation interest on Eglin (including non FNAI-tracked species) to 64 (Table 5).

In addition, there are three species new to FNAI's tracking list that have potential to be found on Eglin (*Forestiera godfreyi, Fothergilla gardenii,* and *Najas filifolia*) (Chafin, pers. comm. 1999). Because we lack information on the presence of these three species at Eglin, they are not included in the following analyses.

Prioritizing species to monitor and determining levels of monitoring needed. In deciding which species to monitor several factors were considered:

- The rarity of the species from a global and statewide perspective. Measures of rarity come from the ranks assigned by FNAI/TNC, the state of Florida, and the Federal government.

- The importance of the Eglin populations to the overall survival of the species. One measure of this is the percentage of the total number of occurrences in the FNAI database that occur Eglin. This measure is admittedly imperfect due to differing intensities of survey effort in different parts of the state. Since Eglin has been relatively intensively surveyed compared to the rest of Florida, an indication that Eglin is not important to the overall numbers of the species in the state is more reliable than an indication that it is.

- Threats to the species on Eglin. An assessment of activities that might affect each species and the sensitivity of the populations to these threats was given in Chafin and Schotz (1995). This information was reviewed and updated for the present report. Threats may change with time and thus need to be re-evaluated periodically.

- Whether or not the status of the species can be linked to that of a specific community. Is the species frequent enough in a particular natural community that suitable examples of the community can be assumed to contain it? In other words, can community level monitoring be a surrogate for monitoring specific rare plant species?

Results and Discussion

Updated list of all rare plant species on Eglin, grouped by rarity and importance on Eglin. **Table 5** shows the updated list of all rare plant species on Eglin, placed into five groups by their FNAI global rank and then by percentage of their occurrences in the FNAI database on Eglin. This ordering shows the importance of the Eglin populations to the status of species with different degrees of state and global rarity from highest to lowest. An explanation of rarity rankings can be found in **Appendix F** of this report.

Removal of species for which community monitoring can serve as a surrogate for species monitoring. To develop a list of rare plants to monitor, the list of all rare plants in Table 5 was pared down by removing species for which community-level monitoring is a suitable surrogate for species-level monitoring. These species have a high number of occurrences on Eglin (>25) and are known to be faithfully present in any example of the community having suitable microsites for the species. Most of these species also have relatively low rarity rankings (G3/S3). **Table 6** lists the species removed for this reason, ordered by community and percent of occurrences on Eglin. *Pinguicula primuliflora* has a low number of occurrences on Eglin because it has not had a systematic survey. (It was added to list of FNAI-tracked species after the 1995.) It was included in Table 5 based on the author's field experience with the species at Blackwater River State Forest where it was found to be faithfully present along blackwater streams with seepage banks having sphagnum moss. *Chrysopsis godfreyi* also has fewer than 25 occurrences on Eglin, but several of these are large (>1000 plants) and the species is faithfully present in suitable habitat on Santa Rosa Island (Johnson *et al.*, 2000).

Species removed from monitoring list due to minimal importance of Eglin populations to species' survival. Table 5 was further pared down by removing species for which the Eglin populations are not important to the overall survival of the species in Florida (**Table 7**). This may occur because Eglin is at the edge of the species range or does not contain much suitable habitat for the species. These species have a low percentage of occurrences on Eglin (< 15%) and a relatively high absolute number of occurrences in the state

Table 5. All rare plant species on Eglin grouped by rarity rank and by percentage of total state occurrences on Eglin.

Scientific name	Common name	FNAI Global Rank	FNAI State Rank	Federal Rank	State Rank	# of occurrences on Eglin	# of occurrences in state	percentage total state occurrences on Eglin	EGCP target	Primary natural community	Potential Threats
Group 1 - G1 (alphabetically)											
Cladonia perforata	Perforate reindeer lichen	G1	S1	LE	LE	8	25	32	N	scrub	storm overwash; trampling
Lilium iridolle	Panhandle lily	G1G2	S1S2	N	LE	33	79	42	Y	baygall	change in sedimentation/hydrology
Rhynchospora crinipes	Hairy-peduncled beakrush	G1	S1	N	LE	11	17	65	Y	seepage stream	change in hydrology
Group 2 - G2T2 (by percent on Eglin)											
Lindera subcoriacea	Bog spicebush	G2	S1	N	LE	1	1	100	Y	baygall	hogs/hydrology/erosion
Nuphar lutea ssp. *ulvacea*	West Florida cowlily	G5T2	S2	N	N	22	27	81	Y	blackwater stream	erosion from road contruction/logging
Matelea alabamensis	Alabama spiny-pod	G2	S2	N	LE	20	26	77	Y	upland hardwood forest	logging
Carex baltzelli	Baltzell's sedge	G2	S2	N	LT	90	120	75	Y	upland hardwood forest	logging
Chrysopsis gossypina ssp. *cruiseana*	Cruise's goldenaster	G5T2	S2	N	LE	40	67	60	Y	coastal grassland	storm overwash/trampling
Rhexia salicifolia	Panhandle meadowbeauty	G2	S2	N	LT	23	48	48	Y	depression marsh	ORV's/hydrology
Xyris longisepala	Karst pond xyris	G2	S2	N	LE	15	36	42	Y	sandhill upland lake	ORV's
Magnolia ashei	Ashe's magnolia	G2	S2	N	LE	32	90	36	Y	upland hardwood forest	logging/accidental ignition
Rhexia parviflora	Small-flowered meadowbeauty	G2	S2	N	LE	10	32	31	Y	depression marsh	ORV's/lack of fire
Chrysopsis godfreyi	Godfrey's goldenaster	G2	S2	N	LE	18	69	26	Y	beach dune	storm overwash
Polygonella macrophylla	Large-leaved jointweed	G2	S2	N	LT	23	150	15	Y	scrub	
Sideroxylon thornei	Thorne's buckthorn	G2	S1	N	LE	1	7	14	N	floodplain forest	logging/hydrology
Linum westii	West's flax	G2	S2	N	LE	2	16	13	Y	wet flatwoods	hydrology/lack of fire
Hymenocallis henryae	Panhandle spiderlily	G2	S2	N	LE	1	24	4	Y	strand swamp	hydrology/lack of fire
Asclepias viridula	Southern milkweed	G2	S2	C	LT	1	53	2	Y	wet flatwoods	lack of fire
Lupinus westianus	Gulf coast lupine	G2	S2	N	LT	2	109	2	Y	scrub	
Group 3 - G3 (by percent on Eglin)											
Tephrosia mohrii	Pineland hoary pea	G3	S3	N	LT	162	165	98	Y	sandhill	lack of fire
Baptisia calycosa var. *villosa*	Hairy wild indigo	G3T3	S3	N	LT	194	205	95	Y	sandhill	lack of fire
Quercus arkansana	Arkansas oak	G3	S3	N	LT	133	143	93	Y	upland hardwood forest	lack of fire in ecotones
Sarracenia rubra	Sweet pitcher plant	G3	S3	N	LT	186	207	90	Y	baygall	hogs/hydrology/erosion
Panicum nudicaule	Naked-stemmed panic grass	G3?	S2?	N	LT	69	80	86	Y	seepage slope	hog/sedimentation
Xyris drummondii	Drummond's yelllow-eyed grass	G3	S3	N	N	81	116	70	N	seepage slope	hogs/hydrology/lack of fire
Xyris scabrifolia	Harper's yellow-eyed grass	G3	S3	N	LT	52	81	64	N	seepage slope	hogs/hydrology/lack of fire
Lachnocaulon digynum	Bog button	G3	S2?	N	LT	43	68	63	N	seepage slope	hogs/hydrology
Rhododendron austrinum	Orange azalea	G3G4	S3	N	LE	24	56	43	Y	upland hardwood forest	avoid aerial ignition
Sarracenia leucophylla	White-top pitcher plant	G3	S3	N	LE	132	321	41	Y	seepage slope	hogs/hydrology/lack of fire
Calamintha dentata	Toothed savory	G3	S3	N	LT	14	39	36	Y	sandhill	lack of fire
Macranthera flammea	Hummingbird flower	G3	S2	N	LE	5	16	31	Y	freshwater tidal swamp	hogs/hydrology/lack of fire
Calamovilfa curtissii	Curtiss' sandgrass	G3	S3		LT	61	201	30	Y	wet flatwoods	hydrology/lack of fire
Aristida simpliciflora[1]	Southern three-awned grass	G3	S2	N	N	5	17	29	Y	sandhill	lack of fire
Andropogon arctatus	Pine-woods bluestem	G3	S3	N	N	12	53	23	Y	mesic flatwoods	hogs/lack of fire
Coelorachis tuberculosa	Piedmont jointgrass	G3	S3	N	LT	5	35	14	Y	sandhill upland lake	lack of fire
Pinguicula primuliflora	Primrose-flowered butterwort	G3G4	S3	N	LE	2	14	14	N	seepage slope	hogs/hydrology/lack of fire
Litsea aestivalis	Pondspice	G3	S2	N	LE	2	15	13	N	pond edge	hydrology
Myriophyllum laxum	Piedmont water-milfoil	G3	S2S3	N	N	2	20	10	N	blackwater stream	sedimentation
Group 4 - G4, G5 (by state rank and then by per cent on Eglin)											
Xanthorhiza simplicissima	Yellow root	G5	S1	N	LE	3	4	75	N	slope forest	avoid aerial ignition
Medeola virginiana	Indian cucumber -root	G5	S1	N	LE	1	2	50	N	baygall	logging
Cladium mariscoides	Pond rush	G5	S1	N	N	3	7	43	Y	dome swamp	lack of fire

Table 5. All rare plant species on Eglin grouped by rarity rank and by percentage of total state occurrences on Eglin.

Scientific name	Common name	FNAI Global Rank	FNAI State Rank	Federal Rank	State Rank	# of occurrences on Eglin	# of occurrences in state	percentage total state occurrences on Eglin	EGCP target	Primary natural community	Potential Threats
Juncus gymnocarpus	Coville's rush	G4	S1	N	LE	4	10	40	Y	baygall	logging/sedimentation
Eleocharis rostellata	Beaked spikerush	G5	S1	N	LE	1	3	33	N	brackish marsh	
Monotropa hypopithys	Pinesap	G5	S1	N	LE	3	11	27	Y	upland hardwood forest	logging
Lilium michauxii	Carolina lily	G4G5	S1S2	N	LE	2	9	22	N	upland hardwood forest	hogs/hydrology
Ilex amelanchier	Serviceberry holly	G4	S2	N	LT	11	16	69	N	floodplain swamp	hydrology
Epigaea repens	Trailing arbutus	G5	S2	N	LE	8	16	50	N	upland hardwood forest	avoid aerial ignition
Carex tenax	Sandhill sedge	G5?	S2	N	N	13	28	46	N	sandhill	lack of fire
Calycanthus floridus	Sweet shrub	G5	S2	N	LE	2	11	18	N	upland hardwood forest	avoid aerial ignition
Rhynchospora stenophylla	Narrow-leaved beakrush	G4	S2S3	N	LT	6	25	24	N	seepage slope	hogs/hydrology/lack of fire
Stewartia malacodendron	Silky camelia	G4	S3	N	LE	33	52	63	N	upland hardwood forest	avoid aerial ignition
Kalmia latifolia	Mountain laurel	G5	S3	N	LT	33	60	55	N	upland hardwood forest	avoid aerial ignition
Hexastylis arifolia	Heartleaf	G5	S3	N	LT	25	51	49	N	upland hardwood forest	
Malaxis unifolia	Green adder's-mouth	G5	S3	N	LE	6	17	35	N	upland mixed forest	avoid aerial ignition
Magnolia pyramidata	Pyramid magnolia	G4	S3	N	LE	3	49	6	N	upland hardwood forest	avoid aerial ignition
Platanthera integra	Yellow fringeless orchid	G4	S3S4	N	LE	4	42	10	Y	seepage slope	hogs/hydrology/lack of fire
Group 5 - Unranked (listed alphabetically)											
Aster chapmanii	Shinner's aster	N	N	N	N	2	N/A	N/A	Y	seepage slope	hogs/hydrology/lack of fire
Aster eryngifolius	Snakeroot aster	N	N	N	N	15	N/A	N/A	Y	mesic flatwoods	lack of fire
Drosera intermedia	Spoon-leaved sundew	N	N	N	LT	61	146	42	N	baygall	hogs/hydrology/lack of fire
Helianthemum arenicola	Gulf rockrose	N	N	N	N	19	N/A	N/A	Y	coastal grassland	
Illicium floridanum	Florida anise	N	N	N	LT	159	N/A	N/A	N	baygall	logging/hydrology
Lilium catesbei	Southern red lily	N	N	N	N	31	192	16	N	seepage slope	
Peltandra sagittifolia	Spoon flower	N	N	N	N	79	105	75	N	blackwater stream	hydrology
Pinguicula planifolia	Chapman's butterwort	N	N	N	LT	79	105	75	Y	seepage slope	hogs/hydrology/lack of fire
TOTAL = 63 species (including 8 not tracked by FNAI)											
Plants tracked by FNAI that are Potentially on Eglin Air Force Base:											
Forestiera godfreyi	Godfrey's privet	G3	S2S3	N	LE		13		N		
Fothergilla gardenii	Dwarf witch-alder	G4	S1	N	N		1		N		
Najas filifolia	Narrowleaf naiad	G1	S1	N	LT		9		Y		
1 - due to be removed from FNAI list											

Table 6. Rare plant species on Eglin that may be captured by community monitoring. Listed by primary natural community.

Scientific name	Common name	Primary natural community	FNAI Global Rank	FNAI State Rank	Federal Rank	State Rank	# eo's on Eglin	# eo's in state - 6/98	percentage total state eors on Eglin	EGCP target	Potential Threats
Sarracenia rubra	Sweet pitcher plant	baygall	G3	S3	N	LT	186	207	90	Y	hogs/hydrology/erosion
Chrysopsis gossypina ssp. *cruiseana*	Cruise's goldenaster	beach dune	G5T2	S2	N	LE	40	67	60	Y	storm overwash/trampling
Chrysopsis godfreyi - large populations	Godfrey's goldenaster	beach dune	G2	S2	N	LE	18	69	26	Y	storm overwash
Pinguicula primuliflora - undercounted	Primrose-flowered butterwort	blackwater stream	G3G4	S3	N	LE	2	14	14	N	hogs/hydrology/lack of fire
Tephrosia mohrii	Pineland hoary pea	sandhill	G3	S3	N	LT	162	165	98	Y	lack of fire
Baptisia calycosa var. *villosa*	Hairy wild indigo	sandhill	G3T3	S3	N	LT	194	205	95	Y	lack of fire
Panicum nudicaule	Naked-stemmed panic grass	seepage slope	G3?	S2?	N	LT	69	80	86	Y	hog/sedimentation
Xyris drummondii	Drummond's yelllow-eyed grass	seepage slope	G3	S3	N	N	81	116	70	N	hogs/hydrology/lack of fire
Xyris scabrifolia	Harper's yellow-eyed grass	seepage slope	G3	S3	N	LT	52	81	64	N	hogs/hydrology/lack of fire
Lachnocaulon digynum	Bog button	seepage slope	G3	S2?	N	LT	43	68	63	N	hogs/hydrology
Sarracenia leucophylla	White-top pitcher plant	seepage slope	G3	S3	N	LE	132	321	41	Y	hogs/hydrology/lack of fire
Quercus arkansana	Arkansas oak	upland hardwood forest	G3	S3	N	LT	133	143	93	Y	lack of fire in ecotones
Carex baltzelli	Baltzell's sedge	upland hardwood forest	G2	S2	N	LT	90	120	75	Y	logging
Stewartia malacodendron	Silky camelia	upland hardwood forest	G4	S3	N	LE	33	52	63	N	avoid aerial ignition
Kalmia latifolia	Mountain laurel	upland hardwood forest	G5	S3	N	LT	33	60	55	N	avoid aerial ignition
Hexastylis arifolia	Heartleaf	upland hardwood forest	G5	S3	N	LT	25	51	49	N	avoid aerial ignition
Rhododendron austrinum	Orange azalea	upland hardwood forest	G3G4	S3	N	LE	24	56	43	Y	avoid aerial ignition
Calamovilfa curtissii	Curtiss' sandgrass	wet flatwoods	G3	S3		LT	61	201	30	Y	hydrology/lack of fire
TOTAL = 18 species											

Table 7. Rare plant species on Eglin AFB removed from monitoring list due to minimal importance of Eglin populations to species' survival.

Scientific name	Common name	FNAI Global Rank	FNAI State Rank	Federal Rank	State Rank	# eo's on Eglin	# eo's in state	% state eors on Eglin	EGCP target	Primary natural community	Threats
Species tracked by FNAI :											
Asclepias viridula	Southern milkweed	G2	S2	C	LT	1	53	2	Y	wet flatwoods	lack of fire
Lupinus westianus	Gulf coast lupine	G2	S2	N	LT	2	109	2	Y	scrub	
Coelorachis tuberculosa	Piedmont jointgrass	G3	S3	N	LT	5	35	14	Y	sandhill upland lake	lack of fire
Magnolia pyramidata	Pyramid magnolia	G4	S3	N	LE	3	49	6	N	upland hardwood forest	avoid aerial ignition
Platanthera integra	Yellow fringeless orchid	G4	S3S4	N	LE	4	42	10	Y	seepage slope	hogs/hydrology/lack of fire
Species not tracked by FNAI:											
Aristida simpliciflora[1]	Southern three-awned grass	G3	S2	N	N	5	17	29	Y	sandhill	lack of fire
Aster chapmanii	Shinner's aster	N	N	N	N	2	N/A	N/A	Y	seepage slope	hogs/hydrology/lack of fire
Aster eryngifolius	Snakeroot aster	N	N	N	N	15	N/A	N/A	Y	mesic flatwoods	lack of fire
Drosera intermedia	Spoon-leaved sundew	N	N	N	LT	61	146	42	N	baygall	hogs/hydrology/lack of fire
Helianthemum arenicola	Gulf rockrose	N	N	N	N	19	N/A	N/A	Y	coastal grassland	storm overwash/trampling
Illicium floridanum	Florida anise	N	N	N	LT	159	N/A	N/A	N	baygall	logging/hydrology
Lilium catesbei	Southern red lily	N	N	N	N	31	192	16		seepage slope	hogs/hydrology/lack of fire
Peltandra sagittifolia	Spoon flower	N	N	N	N	79	105	75		blackwater stream	hydrology
Pinguicula planifolia	Chapman's butterwort	N	N	N	LT	79	105	75	Y	seepage slope	hogs/hydrology/lack of fire
TOTAL = 14 species											
1 - due to be removed from FNAI list											

Table 8. Rare plant species recommended for monitoring, listed by degree of threat.

Degree of Threat H=high; M=medium; L=low	Scientific name	Common name	FNAI Global Rank	FNAI State Rank	Federal Rank	State Rank	Primary natural community	Potential Threats	Specific threats (and hindrances to monitoring)
H	*Cladonia perforata*	Perforate reindeer lichen	G1	S1	LE	LE	scrub	storm overwash; trampling	population reduced by storm; trampling observed
H	*Lindera subcoriacea*	Bog spicebush	G2	S1	N	LE	baygall	hogs/hydrology/erosion	observed to be affected by clearing of underbrush for fishing - vulnerable area near Army Ranger activities - only population in state
H	*Sideroxylon thornei*	Thorne's buckthorn	G2	S1	N	LE	floodplain forest	logging/hydrology	only one population on Eglin
H	*Linum westii*	West's flax	G2	S2	N	LE	wet flatwoods	hydrology/lack of fire	only two populations on Eglin
H	*Hymenocallis henryae*	Panhandle spiderlily	G2	S2	N	LE	strand swamp	hydrology/lack of fire	only one population on Eglin
H	*Litsea aestivalis*	Pondspice	G3	S2	N	LE	pond edge	hydrology	only one population on Eglin
H	*Myriophyllum laxum*	Piedmont water-milfoil	G3	S2S3	N	N	blackwater stream	sedimentation	only two populations on Eglin (one accessible only by canoe)
H	*Ilex amelanchier*	Serviceberry holly	G4	S2	N	LT	floodplain swamp	hydrology/fire	may be sensitive to fire - population on Apalachicola N.F. not found following controlled burn to edge of stream
H	*Lilium michauxii*	Carolina lily	G4G5	S1S2	N	LE	upland hardwood forest	hogs/hydrology	only two populations on Eglin
H	*Eleocharis rostellata*	Beaked spikerush	G5	S1	N	LE	brackish marsh	hydrology	only one population on Eglin
H	*Calycanthus floridus*	Sweet shrub	G5	S2	N	LE	upland hardwood forest	avoid aerial ignition	only two populations on Eglin
H	*Medeola virginiana*	Indian cucumber -root	G5	S1	N	LE	baygall	logging	only one population on Eglin
M	*Lilium iridolle*	Panhandle lily	G1G2	S1S2	N	LE	baygall	change in sedimentation/hydrology	sensitive to road construction across streams; Eglin popualtions one reason not federally listed
M	*Matelea alabamensis*	Alabama spiny-pod	G2	S2	N	LE	upland hardwood forest	logging	One reason not federally listed is Eglin populations deemed safe and Eglin populations most vigorous known.
M	*Rhexia salicifolia*	Panhandle meadowbeauty	G2	S2	N	LT	depression marsh	ORV's/hydrology	species threatened around karst ponds off Eglin - Eglin important to species persistance
M	*Xyris longisepala*	Karst pond xyris	G2	S2	N	LE	sandhill upland lake	ORV's	species threatened around karst ponds off Eglin - Eglin important to species persistance
M	*Polygonella macrophylla*	Large-leaved jointweed	G2	S2	N	LT	scrub	canopy closure	species occurs in disturbed areas vulnerable to destruction; shading from canopy closure
M	*Rhynchospora stenophylla*	Narrow-leaved beakrush	G4	S2S3	N	LT	seepage slope	hogs/hydrology/lack of fire	hog rooting problem (difficult to identify)
L	*Rhynchospora crinipes*	Hairy-peduncled beakrush	G1	S1	N	LE	seepage stream	change in hydrology	occurs in ephemeral habitat on sand banks in streams; natural persistence at sites unknown but not sensitive to management actions
L	*Nuphar lutea* ssp. *ulvacea*	West Florida cowlily	G5T2	S2	N	N	blackwater stream	erosion from road construction/logging	no immediate threat perceived
L	*Rhexia parviflora*	Small-flowered meadowbe	G2	S2	N	LE	depression marsh	ORV's/lack of fire	no immediate threat perceived
L	*Magnolia ashei*	Ashe's magnolia	G2	S2	N	LE	upland hardwood forest	logging/accidental ignition	no immediate threat perceived
L	*Macranthera flammea*	Hummingbird flower	G3	S2	N	LE	freshwater tidal swamp	hogs/hydrology/lack of fire	no immediate threat perceived
L	*Calamintha dentata*	Toothed savory	G3	S3	N	LT	sandhill	lack of fire	(habitat preferences and population dynamics on Eglin unknown)
L	*Andropogon arctatus*	Pine-woods bluestem	G3	S3	N	N	mesic flatwoods	lack of fire	(only identifiable in flowers which occurs the first year after fire)
L	*Juncus gymnocarpus*	Coville's rush	G4	S1	N	LE	baygall	logging/sedimentation	no immediate threat perceived
L	*Monotropa hypopithys*	Pinesap	G5	S1	N	LE	upland hardwood forest	logging	no immediate threat perceived
L	*Cladium mariscoides*	Pond rush	G5	S1	N	N	dome swamp	lack of fire	only one population on Eglin
L	*Xanthorhiza simplicissima*	Yellow root	G5	S1	N	LE	slope forest	avoid aerial ignition	three popsulations equal high percentage of state population
L	*Epigaea repens*	Trailing arbutus	G5	S2	N	LE	upland hardwood forest	avoid aerial ignition	no immediate threat perceived
L	*Carex tenax*	Sandhill sedge	G5?	S2	N	N	sandhill	lack of fire	unknown (difficult to identify)
L	*Malaxis unifolia*	Green adder's-mouth	G5	S3	N	LE	upland mixed forest	avoid aerial ignition	no immediate threat perceived

as a whole (> 30). Also included in this list are the five species removed from the list of FNAI-tracked species, one (*Aristida simpliciflora*) that is due to be removed as the result of a recent status survey showing it was more common than previously thought (Sorrie and Chafin 2000), and two that were included in the 1995 survey, but were never on the list of FNAI-tracked species, bringing the total to 14.

Species grouped by degree of threat. The remaining 32 species were ranked in terms of the estimated degree of specific human-caused threats to their populations on Eglin in **Table 8**. Threats to species that have only 1 or 2 populations on Eglin are automatically considered high due to the possibility of accidental elimination. Other threats were determined from the discussion in Chafin and Schotz (1995) and from knowledge of individual cases, and are described in the last column of Table 7. Overall endangerment of the species off Eglin is considered to be reflected in the FNAI rarity ranking and is not considered in determining specific threats.

The final list of 32 rare species recommended for monitoring on Eglin, in priority groups. After removal of species not recommended for monitoring (Tables 6 and 7) and an assessment of threats to the remaining 32 species (Table 8), FNAI grouped the 32 species according to three criteria: rarity, percentage of occurrences on Eglin, and degree of threat. **Table 9** shows the 32 species, listed in eight priority groupings. Listed below are descriptions of the criteria for each group and the recommended monitoring approach for the group.

For each group or species, FNAI suggests one of three basic levels of monitoring of known occurrences. The most detailed is population-level monitoring, consisting of following a sample of individual plants within each occurrence. This is recommended for only one species (*Cladonia perforata* - see below). Mid-level monitoring consists of noting presence/absence and a rough categorical estimate of size for every species occurrence. For these species, FNAI recommends adopting the suggestion in Hardesty *et al.* (1997) that all known sites be monitored if < 30 occurrences exist. Since only two species in Table 9 have more than 30 occurrences, and these are only slightly more than 30, FNAI recommends that all occurrences be monitored. The third, and lowest level of monitoring consists of geographically mapping and tracking threats to species occurrences rather than monitoring the plants themselves. The assumption for this lowest level of monitoring is that as long as threats are diverted from the rare plant occurrences, the plants should persist. It will also allow for an accounting of instances where occurrences received threatening activity.

Table 9. Priority groupings of rare plant species recommended for monitoring. Grouped by rank, percentage of occurrences on Eglin, and threat.

Scientific name	Common name	Degree of Threat H=high M=medium L=low	FNAI Global Rank	Federal Rank	State Rank	% state EORs on Eglin	Primary natural community	Potential Threats	Specific threats (and hindrances to monitoring)
Group 1 - high rank (G1/G2), high to medium percentage on Eglin, high threat									
Cladonia perforata	Perforate reindeer lichen	H	G1	LE	LE	32	scrub	storm overwash; trampling	population reduced by storm; trampling observed; federallly listed species
Lindera subcoriacea	Bog spicebush	H	G2	N	LE	100	baygall	hogs/hydrology/erosion	observed to be affected by clearing of underbrush for fishing - vulnerable area near Army Ranger activities - only population in state
Sideroxylon thornei	Thorne's buckthorn	H	G2	N	LE	14	floodplain forest	logging/hydrology	only one population on Eglin
Group 2 - high rank (G1/G2), high to medium percentage on Eglin, medium to low threat									
Lilium iridolle	Panhandle lily	M	G1G2	N	LE	42	baygall	change in sedimentation/hydrology	sensitive to road construction across streams; Eglin reason not federally listed
Rhynchospora crinipes	Hairy-peduncled beakrush	L	G1	N	LE	65	seepage stream	change in hydrology	occurs in ephemeral habitat on sand banks in streams; natural persistence at sites unknown but not sensitive to management actions
Matelea alabamensis	Alabama spiny-pod	M	G2	N	LE	77	upland hardwood forest	logging	Eglin populations most vigorous known and reason not federally listed
Rhexia salicifolia	Panhandle meadowbeauty	M	G2	N	LT	48	depression marsh	ORV's/hydrology	species threatened around karst ponds off Eglin - Eglin important to species persistance
Xyris longisepala	Karst pond xyris	M	G2	N	LE	42	sandhill upland lake	ORV's	species threatened around karst ponds off Eglin - Eglin important to species persistance
Nuphar lutea ssp. ulvacea	West Florida cowlily	L	G5T2	N	N	81	blackwater stream	erosion from road construction/logging	no immediate threat perceived
Rhexia parviflora	Small-flowered meadowbeauty	L	G2	N	LE	31	depression marsh	ORV's/lack of fire	no immediate threat perceived
Magnolia ashei	Ashe's magnolia	L	G2	N	LE	36	upland hardwood forest	logging/accidental ignition	no immediate threat perceived
Group 3 - high rank (G1/G2), low percentage on Eglin, high threat									
Linum westii	West's flax	H	G2	N	LE	13	wet flatwoods	hydrology/lack of fire	only two populations on Eglin
Hymenocallis henryae	Panhandle spiderlily	H	G2	N	LE	4	strand swamp	hydrology/lack of fire	only one population on Eglin
Litsea aestivalis	Pondspice	H	G3	N	LE	7	pond edge	hydrology	only one population on Eglin
Group 4 - high rank (G1/G2), low percentage on Eglin, medium threat									
Polygonella macrophylla	Large-leaved jointweed	M	G2	N	LT	15	scrub	canopy closure	canopy closure
Group 5 - intermediate rank (G3, S2/S3), medium percentage on Eglin, low threat and species with low percentage on Eglin and high threat.									
Macranthera flammea	Hummingbird flower	L	G3	N	LE	31	swamp	hogs/hydrology/lack of fire	no immediate threat perceived
Calamintha dentata	Toothed savory	L	G3	N	LT	36	sandhill	lack of fire	(population dynamics on Eglin unknown)
Andropogon arctatus-ID only	Pine-woods bluestem	L	G3	N	N	23	mesic flatwoods	lack of fire	(only flowers after fire)
Myriophyllum laxum	Piedmont water-milfoil	H	G3	N	N	10	blackwater	sedimentation	only 2 populations -one population accessible only by canoe
Group 6 - low G-rank (G4/G5),high S-rank (S1/S2), high percentage on Eglin, high threat									
Lilium michauxii	Carolina lily	H	G4G5	N	LE	22	forest	hogs/hydrology	only two populations on Eglin
Xanthorhiza simplicissima	Yellow root	L	G5	N	LE	75	slope forest	avoid aerial ignition	few pops; high percentage of state population
Eleocharis rostellata	Beaked spikerush	H	G5	N	LE	33	brackish marsh	hydrology	only one population on Eglin
Calycanthus floridus	Sweet shrub	H	G5	N	LE	18	upland hardwood forest	avoid aerial ignition	only two populations on Eglin
Medeola virginiana	Indian cucumber -root	H	G5	N	LE	50	baygall	logging	only one population on Eglin
Juncus gymnocarpus	Coville's rush	L	G4	N	LE	40	baygall	logging/sedimentation	no immediate threat perceived
Monotropa hypopithys	Pinesap	L	G5	N	LE	27	upland hardwood forest	logging	no immediate threat perceived
Cladium mariscoides	Pond rush	L	G5	N	N	43	dome swamp	lack of fire	only one population on Eglin

Table 9. Priority groupings of rare plant species recommended for monitoring. Grouped by rank, percentage of occurrences on Eglin, and threat.

Scientific name	Common name	Degree of Threat H=high M=medium L=low	FNAI Global Rank	Federal Rank	State Rank	% state EORs on Eglin	Primary natural community	Potential Threats	Specific threats (and hindrances to monitoring)
Group 7 - low G-rank, medium S-rank, high percentage on Eglin, medium threat									
Ilex amelanchier	Serviceberry holly	H	G4	N	LT	69	floodplain swamp	hydrology/fire	may be sensitive to fire - population on Apalachicola N.F. gone following controlled burn to edge of stream
Rhynchospora stenophylla	Narrow-leaved beakrush	M	G4	N	LT	24	seepage slope	hogs/hydrology/lack of fire	hog rooting problem
Group 8 - low G-rank, low S-rank, high percentage on Eglin, low threat									
Epigaea repens	Trailing arbutus	L	G5	N	LE	50	forest	avoid aerial ignition	no immediate threat perceived
Carex tenax	Sandhill sedge	L	G5?	N	N	46	sandhill	lack of fire	unknown
Malaxis unifolia	Green adder's-mouth	L	G5	N	LE	35	upland mixed forest	avoid aerial ignition	no immediate threat perceived
TOTAL = 32									

Explanation of Table 9 priority groups:

- **Group 1** (3 species).
  Criteria: all three factors ranked high (rarity, percent of occurrences, threats). One of these is the federally listed lichen, *Cladonia perforata*. Eglin contains the only Florida population of the highly ranked, *Lindera subcoriacea*. Only 7 occurrences of *Sideroxylon thornei* exist in Florida, and Eglin has one population.

  Monitoring level: The type of monitoring for these species must be determined individually. For example, presence/absence may be sufficient, or monitoring population size may be necessary. Alternatively, monitoring the population indirectly through monitoring threats may be sufficient. FNAI developed a monitoring plan for *Cladonia perforata* **Appendix D**.

- **Group 2** (8 species)
  Criteria: rarity rank is high, percentage on Eglin is high to medium, but threat on Eglin is medium to low.

  Monitoring level: All occurrences of these species could be monitored less frequently, perhaps every 2 years, since the Eglin populations are important to the survival of these species, but the threat on Eglin is perceived to be low. Presence/absence and rough estimates of size for all occurrences on Eglin should be sufficient (see next paragraph). If resources do not permit such intensive monitoring of all these species, the highest priority should be given to those three species with over 70% of their populations on Eglin, *Rhynchospora crinipes, Matelea alabamensis*, and *Nuphar lutea* ssp *ulvacea*.

  FNAI developed a monitoring plan for *Matelea alabamensis* as an example for species in this and subsequent groups (**Appendix E**). Monitoring is for presence/absence and rough estimates of occurrence size for every known occurrence on Eglin. This basic approach can be followed for all subsequent groups where presence/absence monitoring is deemed appropriate. The frequency of monitoring can vary, and be less intense for groups lower on the priority list. Monitoring for Group 2 species should be 2 years.

- **Group 3** (3 species)
  Criteria: rarity rank is high and threat is high by virtue of the species' having only one or two occurrences on Eglin, but percentage of occurrences on Eglin is low. Even though their Eglin populations are not a high percentage of the statewide total, the total number of occurrences is small enough that all populations are important to survival of the species, as reflected in their high rarity ranking.

  Monitoring level: monitor presence/absence every 2 years. *Linum westii* may not be feasible to monitor due to the difficulty of locating the small plants within dense

wiregrass (A. Schotz, pers. comm., 2000). Its locations could be carefully protected by the procedure recommended for Groups 6-8 below.

- **Group 4** (1 species).
  Criteria: *Polygonella macrophylla* has a high rank, medium threat, and low percentage of occurrences on Eglin, but differs from Group 3 in having a higher absolute number of occurrences, both on and off Eglin.

  Monitoring level: all occurrence should be monitored for presence/absence every 3 years.

- **Group 5** (4 species)
  Criteria: species have intermediate rank, intermediate percentage on Eglin and low threat.

  Monitoring level: Pinewoods bluestem *(Andropogon arctatus)* may not be feasible to monitor since it is only identifiable in flower and it flowers only after fire. The other three species in this group, plus the one species in Group 4, could be monitored every 3 years.

- In **Group 6** (8 species)
  Criteria: species are rare in the state, but are secure throughout their range. They have few populations on Eglin and in the state. Since they are at the edge of their range, the main threats would probably be natural and not controllable by management activities. They are sensitive, however, to inadvertent destruction by Eglin activities by virtue of having so few occurrences.

  Monitoring level: FNAI recommends geographically mapping and tracking threats to species occurrences in Group 6 rather than monitoring the plants themselves. The concept is to establish a geographical accounting system for instances where rare plant occurrences receive threatening activities. The assumption here is that as long as threats are diverted from the rare plant occurrences, the plants should persist. For example, maps of planned logging operations can be compared to locations of rare species occurrences. If an operation overlaps with an occurrence, then the corresponding management action may be to either move the operation (avoidance), take measures in the field to protect the occurrence by flagging, redesigning operation boundaries, etc (avoidance)., or simply to proceed with the operation as originally scheduled. If the operation is not diverted, then it should be counted as an instance where the occurrence received a direct impact. Thresholds for the number of acceptable direct impacts must be established. FNAI recommends a threshold of no more than 2 occurrences subjected to a directly threatening operation unless more detailed field monitoring demonstrates that the occurrences were not harmed by the operations.

An important component of this lower-level monitoring is also to guide management a priori by re-directing potential threats away from the occurrences. This guidance may best be applied for all rare species at Eglin, or at least the 32 species in Table 9. Maps of rare species' locations should be made available to Eglin land managers and a review procedure established for allowing a project/operation to proceed, if a rare plant is within its boundary, and the activity has potential to negatively impact the plant. FNAI is not aware of the day-to-day review procedures currently in place. It is likely that this type of review process already occurs on Eglin.

- **Groups 7** (2 species) and **8** (3 species).
  Criteria: species are in the same situation as those in Group 6, but have higher numbers of occurrences, both on Eglin and in the state as a whole, and thus are not as vulnerable as the species in Group 6.

  Monitoring level: The same procedure as in Group 6.

Pilot monitoring plans. FNAI developed pilot monitoring plans for two rare plants, one species in Group 1 (*Cladonia perforata*) and a species in Group 2 *(Matelea alabamensis*). These two monitoring plan are given in **Appendices D** and **E**.

Summary of Recommendations.

The 18 species ranked in Groups 1 through 5 are recommended for presence/absence or greater level of monitoring. Species in Group 1 should be monitored yearly with the level of monitoring tailored to the individual species. FNAI developed a monitoring plan for one species in this group, *Cladonia perforata* (Appendix D). It is recommended that species in Groups 2 and 3 are monitored every 2 years for presence/absence and a rough categorical estimate of occurrence size. It is recommended that species in Groups 4 and 5 are monitored every 3 years, with the same data collected as for Groups 2 and 3. FNAI recommends the lowest level of monitoring for Groups 6, 7 and 8, a geographic-based tracking of threats to the species, and only monitoring plants in the field if more than 2 direct threats are known to have occurred for any species in these groups.

TASK 3: NATURAL COMMUNITIES

Introduction

Hardesty *et al.* (1997) recommended that Eglin choose community types for monitoring that are regionally rare or imperiled, imperiled on Eglin, comprise matrix communities within which other communities are embedded, and/or that provide critical habitat for target species. The information provided below is designed to assist Eglin managers in identifying and prioritizing target communities on Eglin for desired future condition work and for future monitoring.

Natural communities are desirable as conservation targets, because they serve as "coarse filters," capturing the plant and animal diversity within them. This assumes that if a natural community or suite of communities are healthy (for example, mesic flatwoods and dome swamps), then the populations of rare plants and animals dependent upon them are also healthy (for example, flatwoods salamander and Curtiss' sandgrass). In a draft list of conservation targets developed by TNC in June of this year for the upcoming September Desired Future Condition workshop at Eglin, natural communities are featured heavily, making up 38 out of 46 targets proposed.

Because of the large number of conservation targets on Eglin, prioritizing is necessary for implementation of a monitoring program for these targets. This report provides a brief analysis of the biodiversity and threats pertaining to the 34 natural community types on Eglin recognized in the FNAI classification. Although all communities on Eglin are indeed important and should be conservation targets, below FNAI recommends seven additional communities that should receive high priority in the start of the monitoring program.

Sandhills and stream systems are already widely recognized at Eglin as vital to maintenance of native biodiversity and ecosystem health. Task 1 of this report dealt with one aspect of a larger proposed monitoring effort focused on ecological condition and fire effects in sandhill systems at Eglin (Hardesty, *et al.* 1997). Riparian systems have also received much attention, particularly in the past year (Litt, *et al.* 2000), and a large-scale aquatic monitoring effort is already underway at Eglin. For these reasons, recognizing that sandhills and riparian aquatic systems are already central to ecological monitoring at Eglin, the following analysis focuses on prioritizing the remaining natural communities.

Methods

The TNC report *The Gulf Coastal Plain Ecosystem Partnership: an assessment of conservation opportunities* (Hardesty, *et al.* 1999) was reviewed for target community types. That report recommends that all native plant communities and identifiable ecological complexes should be targets for conservation in the ecoregion. Using the FNAI classification, this list is 34 community types, and using the present TNC National Classification (Grossman *et al.* 1998),

the list is approximately 98 associations. Because little is known of the distributions of many of the plant associations listed by TNC's national classification, prioritizing these for monitoring may only be possible as these associations become better understood. For this report, FNAI continued to use the FNAI classification (FNAI and DEP 1990) rather than the TNC Classification.

FNAI reviewed and ranked natural communities on Eglin according to biodiversity importance, rarity and threats. FNAI prioritized natural community types for monitoring, considering the following community attributes:

- Species richness (natural communities with high species richness are higher priority)
- The total number of rare plant and animal species that occur in the community and the number of extremely rare plant and animal species (FNAI/TNC ranks G1 and G2) that occur in the community.
- Number of Federally listed plant and animal species that occur in the community
- Community landscape distribution pattern: communities from each distribution type will be chosen: matrix, large patch, small patch.
- Rarity of the natural community globally
- Endemism with respect to the East Gulf Coastal Plain Ecoregion
- Threats to the community type over which Eglin management has some control.

Using a Microsoft Excel™ spreadsheet containing most of the above attributes for each community type, FNAI determined that the best initial sorting of communities was first by degree of threat (high, moderate, low), then by the number of Federally-listed species, then the number of rare plant species within each community. These attributes together captured much of the factors considered above.

From the high and medium threat groupings, FNAI chose eight community types to propose as high priority for initial monitoring efforts. FNAI determined possible metrics or features important to monitoring condition of each metric with respect to human- or exotic species-induced stresses. The metrics proposed were based upon the most immediate or obvious threats to the community and on the least time-consuming methods possible, such as remote sensing, presence/absence, or quick, ocular estimates of indicators.

Because most of FNAI staff time under this agreement was spent on the highest priority task of sandhill groundcover monitoring (Task 1 of this report), therefore the metrics and proposed monitoring methods for other Natural community types presented under Task 3 are brief and preliminary. Review, refinement, and testing the efficacy of these proposed metrics is still needed.

Results and Discussion

Prioritized natural community list for Eglin. The existing FNAI natural community element occurrence records and Eglin Natural Community Survey report (Kindell *et al.* 1997), were analyzed for plant species diversity, rare species, and level of threat. **Table 10** shows the natural communities with corresponding numbers of plant species, rare species, rarity rankings, and threats. The table is sorted by degree of threat, number of Federally-listed species, and number of rare plant species for each community type.

Eight natural communities recommended as high priority for monitoring. FNAI examined the communities in Table 10 that are perceived to be subjected to high and medium levels of threat, and from these determined a preliminary list of eight communities that should be high priority at the start of the Eglin monitoring program (**Table 11**).

Beach dunes harbor two federally listed species, the perforate lichen(*Cladonia perforata*)and the Santa Rosa Beach mouse (*Peromyscus polionotus leucocephalus*), and are associated with an important complex of barrier island communities, vital habitat for many rare plants and animals. Dunes are subject to high threats of disturbance from human foot traffic and hurricane damage. Although hurricane damage is unavoidable, damage by humans is not. Monitoring beach dune condition may be a good indicator of the overall health of the barrier island system. FNAI recommends measuring directly the threat, foot traffic, on the dunes (Table 10). Alternatively, because monitoring of the federally listed species is ongoing, these should be examined as possble surrogates for beach dune health.

Depression marshes on Eglin are important habitats for 10 rare plants and 6 FNAI-tracked animals. Historically, these habitats on Eglin were subject to severe soil disturbance due to illegal ORV traffic. Jackson Guard managers have made great strides in protecting these habitats by placement of vehicle barriers at access points around many depression marshes. The integrity of these barriers and the condition of the depression marsh habitat on Eglin should be periodically monitored to ensure protection. In addition, depression marshes require periodic fire from surrounding sandhills to maintain the open, grassy ecotones necessary for persistence of rare species. Fire return interval, measured by remote sensing, may ultimately be the least costly means of monitoring fire maintenance of depression marshes. However, initially simultaneous measure of shrub encroachment is recommended until the fire return interval can be highly correlated with shrub encroachment in these habitats.

Table 10. Natural communities (NCs) on Eglin, with associated numbers of plant taxa, number of rare plants and animals, TNC/FNAI global and state rarity rankings, numbers of occurrences on Eglin, and the number of taxa with Federal ranking. Likely threats and threat level have been added. Table is sorted by level of threat, number of federally listed species, then number of rare plant species

FNAI community	No.total plant taxa	No. rare animal species	No. rare plant species	TNC / FNAI RANKS		No. of occurrences on Eglin	No. Global Ranked G1&G2 species		Number of federally listed species	Degree of Threat level	Likely threats on Eglin
				Global	State		Animal	Plant			
Beach dune	20	13	1	G4?	S2	10			2	H	Soil disturbance due to human foot traffic, storms.
Depression marsh	120	6	10	G4?	S3	28		3	1	H	Fire suppression of ecotones, soil disturbance from ORVs
Dome swamp	139	2	8	G4?	S3?	61			1	H	Fire suppression of ecotones and soil disturbance from ORVs or firelines.
Wet prairie	138	3	7	G?	S4?	25			1	H	Fire suppression, groundcover and soil disturbance from heavy equipment, firelines.
Sandhill upland lake	60	2	3	G3	S2	5		2	1	H	Fire suppression of ecotones and soil disturbance from ORVs or firelines.
Seepage slope	257	3	12	G3?	S2	136		1		H	Feral hog damage, fire suppression.
Maritime hammock	102	1	1	G4	S3	9				H	Hurricane damage, development as recreation sites.
Seepage stream	81	5	3	G4	S2	21	2	1	1	H-M	Decline in water quality and physical stream characteristics due to erosion (road crossings, borrow pits, feral hogs); anthropogenic changes in water quantity.
Upland hardwood forest	271	3	14	G?	S3	64		3		H-M	Soil erosion due to feral hogs; vehicles or heavy equipment on or near slopes.
Coastal grassland	21	6	2	G3	S2	8		1		H-M	Soil disturbance due to storms, human foot traffic, heavy equipment.
Wet flatwoods	247	7	10	G?	S4?	18		3	3	M	Fire suppression, groundcover and soil disturbance from heavy equipment, exotic species.
Mesic flatwoods	367	8	5	G?	S4	57		2	3	M	Fire suppression, groundcover and soil disturbance from heavy equipment, exotic species.

Beach dune	20	13	1	G4?	S2	10			2	H	Soil disturbance due to human foot traffic, storms.
Depression marsh	120	6	10	G4?	S3	28		3	1	H	Fire suppression of ecotones, soil disturbance from ORVs
Dome swamp	139	2	8	G4?	S3?	61			1	H	Fire suppression of ecotones and soil disturbance from ORVs or firelines.
Wet prairie	138	3	7	G?	S4?	25			1	H	Fire suppression, groundcover and soil disturbance from heavy equipment, firelines.
Sandhill upland lake	60	2	3	G3	S2	5		2	1	H	Fire suppression of ecotones and soil disturbance from ORVs or firelines.
Seepage slope	257	3	12	G3?	S2	136		1		H	Feral hog damage, fire suppression.
Maritime hammock	102	1	1	G4	S3	9				H	Hurricane damage, development as recreation sites.
Seepage stream	81	5	3	G4	S2	21	2	1	1	H-M	Decline in water quality and physical stream characteristics due to erosion (road crossings, borrow pits, feral hogs); anthropogenic changes in water quantity.
Upland hardwood forest	271	3	14	G?	S3	64		3		H-M	Soil erosion due to feral hogs; vehicles or heavy equipment on or near slopes.
Coastal grassland	21	6	2	G3	S2	8		1		H-M	Soil disturbance due to storms, human foot traffic, heavy equipment.
Wet flatwoods	247	7	10	G?	S4?	18		3	3	M	Fire suppression, groundcover and soil disturbance from heavy equipment, exotic species.
Mesic flatwoods	367	8	5	G?	S4	57		2	3	M	Fire suppression, groundcover and soil disturbance from heavy equipment, exotic species.
Baygall	164	8	13	G4?	S4?	22	1	3	2	M	Fire suppression, particularly at edges of baygall.
Sandhill	293	2	6	G2G3	S2	83	1	2	2	M	Fire suppression, groundcover and soil disturbance from heavy equipment.
Upland pine forest	294	7	2	G?	S3	30		1	2	M	Fire suppression, groundcover and soil disturbance from heavy equipment.
Scrubby flatwoods	141	4	3	G3	S3	14		1	1	M	Fire suppression, groundcover and soil disturbance from heavy equipment.
Scrub (mainland) {coastal}	165	(5){?}	(3) {4}	G2	S2	67		(2){3}	1	M	Longterm fire suppression. Inadvertent sand pine removal.
Spring-run stream	25	3	2	G2	S2	1				M	Soil erosion around spring head. Also see seepage streams.
Coastal interdunal swale	25			G3	S2	16				M	Soil disturbance due to storms, human foot traffic, heavy equipment.
Floodplain forest	169	7	8	G?	S3	14	1	3	3	L	Exotic species.
Floodplain swamp	102	7	5	G?	S4?	8	2	1	2	L	Decrease in water quality; anthropogenic water

											baygall.
Sandhill	293	2	6	G2G3	S2	83	1	2	2	M	Fire suppression, groundcover and soil disturbance from heavy equipment.
Upland pine forest	294	7	2	G?	S3	30		1	2	M	Fire suppression, groundcover and soil disturbance from heavy equipment.
Scrubby flatwoods	141	4	3	G3	S3	14		1	1	M	Fire suppression, groundcover and soil disturbance from heavy equipment.
Scrub (mainland) {coastal}	165	(5){?}	(3) {4}	G2	S2	67		(2){3}	1	M	Longterm fire suppression. Inadvertent sand pine removal.
Spring-run stream	25	3	2	G2	S2	1				M	Soil erosion around spring head. Also see seepage streams.
Coastal interdunal swale	25			G3	S2	16				M	Soil disturbance due to storms, human foot traffic, heavy equipment.
Floodplain forest	169	7	8	G?	S3	14	1	3	3	L	Exotic species.
Floodplain swamp	102	7	5	G?	S4?	8	2	1	2	L	Decrease in water quality; anthropogenic water quantity changes.
Backwater stream	16	6	3	G4	S2	5	2	1	2	L	Fire suppression of ecotones and soil disturbance from ORVs or firelines.
Upland mixed forest	196	3	12	G?	S4	15		3	1	L	Catastrophic fire; logging on slopes, soil erosion.
Slope forest	109	2	10	G3	S2	2		1	1	L	Catastrophic fire, logging on slopes, soil erosion, exotic species.
Xeric hammock	149	5	5	G?	S3	16		2	1	L	Catastrophic fire.
Bottomland forest	141	5	4	G4	S4?	6			1	L	Exotic species.
Alluvial stream	15	5	2	G4	S2	1	1		1	L	Fire suppression, groundcover and soil disturbance from heavy equipment.
Swamp lake	59	1	2	G4	S3	3		3	1	L	See floodplain swamp.
River floodplain Lake	11	3	1	G4?	S2	3	1		1	L	See swamp lake.
Bog	67		3	G?	S3	5				L	No threats currently known.
Estuarine tidal marsh	55	7	1	G4	S4	4				L	No threats currently known.
Hydric hammock	95		1	G?	S4?	1				L	Hurricane damage.
Freshwater tidal swamp	46	1	1	G3	S3	1				L	See floodplain swamp.
Basin swamp	23			G4?	S3	5				L	Exotic species.

Table 11. Preliminary list of eight natural communities that should receive high priority for monitoring. Because of monitoring in sandhills and stream systems is already ongoing at Eglin and they are already recognized as high priority for monitoring, they are not proposed below.

Community proposed for monitoring	**Proposed metrics - focused on primary threats listed in Table 9.** **Note: further definition of metrics and threshold values for triggering management action are necessary.**
beach dune	**Percent occurrence of foot trails based on a line-intersect measure,** and **percent occurrence of trails on dune slopes.** Transects stratified by areas perceived as high and low human impact areas. Examine ongoing monitoring of listed species as possible surrogate for beach dune condition.
depression marsh	**Presence/absence of ORV or other soil disturbance in ecotones, fire return interval, shrub encroachment in ecotones** (as initial test of fire return interval).
dome swamp	**Fire return interval, presence/absence of ORV or fireline disturbance, ecotone shrub encroachment** (as initial test of fire return interval metric). Flatwoods salamander monitoring may be appropriate surrogate for dome swamp monitoring in certain areas.
seepage slope	**Fire return interval, percent occurrence and severity of hog/soil damage**. If measurement of fire return interval is by remote sensing, it must be at a scale that ensures that small seepage slopes are burned. Monitoring **shrub encroachment** as an initial test of fire return interval is recommended.
upland hardwood	**Percent occurrence** and **estimate of severity of soil disturbance** and**slope erosion due to feral hogs and anthropogenic causes.**
upland pine forest	**Fire return interval, shrub encroachment** (as initial test of fire return interval), **percent area of community subjected to heavy equipment operations per year and cumulative through time**. Thresholds for number of acres subjected to heavy equipment per year should be established until appropriate groundcover disturbance metrics in these systems are determined. (Wiregrass density may be appropriate metrics.)
wet prairie	**Fire return interval, shrub encroachment** (as initial test of fire return interval metric), **percent area of mechanical and feral hog soil disturbance**.
wet/mesic flatwoods	**Fire return interval,** (initial monitoring of shrub encroachment may be necessary as initial test of fire return interval), **percent area of community subjected to heavy equipment operations per year and cumulative over time**. This is a surrogate for measuring groundcover disturbance. Thresholds for number of acres subjected to heavy equipment per year should be established until appropriate groundcover disturbance metrics in these systems are determined. (Wiregrass (*Arisitida beyrichiana*) density may be appropriate metric.)

Dome swamps are subject to similar issues affecting depression marshes. Dome swamps are typically small, isolated wetlands vital to persistence of many rare plants and animals, particularly herpetofauna. Fires in adjacent flatwoods maintain the grassy ecotones of dome swamps important to rare species. Fire suppression is the greatest threat to dome swamp habitat on Eglin. Soil disturbance is much less prevalent than that which is known for depression marshes, although FNAI has noted a few instances where fire lines were placed in dome swamp ecotones in the southwest portion of the base. It is possible that monitoring efforts for rare species, particularly the flatwoods salamander, may serve as surrogate for monitoring dome swamps. This issue should be explored.

Seepage slopes are well-known on Eglin as harboring the highest plant species richness and large numbers of rare plants of any natural community. They are also relatively habitats throughout the state. The Eglin Wildlife Section has already initiated a monitoring effort to assess feral hog damage on seepage slopes at Eglin. FNAI consulted with Bruce Hagedorn regarding the methods and field techniques Wildlife is using to assess hog damage in seepage slopes. The approach they have developed fits with that envisioned by FNAI, namely conducting yearly damage assessments on a set of randomly selected seepage slopes. Data collected will allow estimates of the percentage of seepage slopes affected, and measures of severity of damage. The longterm monitoring responsibilities (Wildlife or Ecological Monitoring team) should eventually be determined. If Wildlife continues to monitor, then data should be shared with the Ecological monitoring program so that it can be incorporated in base-wide Ecological Condition assessments.

Upland pine forest on clay-based soils in the eastern portion of Eglin are analogous to sandhills, providing a pyrogenic longleaf pine - wiregrass matrix community in which several important communities are embedded (particularly seepage slopes). Upland pine forests are very important habitat for Red-cockaded woodpecker, other rare animals, and rare plants associated with longleaf pine uplands. They are also very rich in numbers of plant species, with a very different flora than sandhills in the western portions of the base. The condition of these forests depends on fire frequency and levels of soil disturbance that affects the wiregrass groundcover.

Upland hardwood forests small, isolated forests associated with steephead stream systems, are vital habitat for large numbers of rare plants, and have a highly diverse plant community that is very different that surrounding longleaf pinelands. They are also an important part of Eglin's stream systems (Litt *et al.* 2000). The primary threat to upland hardwood forests is feral hog damage to understory plants. Although this was noted during FNAI survey work 1993-1996, the problem apparently has increased in recent years (Litt *et al.* 2000). Making an assessment of this problem a high priority is warranted.

Wet prairies are relatively rare on Eglin and have declined dramatically throughout the state. They are particularly vulnerable on Eglin to mechanical soil disturbance (Whitmier island fire lines and Hicks Prairie ORVs). They are also vulnerable to fire suppression, requiring frequent fires to prevent shrub encroachment. Although these issues have been addressed by Eglin

management, an assessment of these threats is warranted to ensure continued health of this community type.

Wet and mesic flatwoods were combined into a single monitoring target. Fire-maintained matrix communities, they are habitats that harbor tremendous rare species diversity. These habitats comprise the second greatest acreage of fire-maintained habitat, behind sandhills. Wet and mesic flatwoods are equally important to sandhills at Eglin for maintenance of native biodiversity. They are also highly vulnerable to exotic species encroachment, fire suppression, and right-of-way encroachments.

Eglin and TNC are preparing to hold a series of workshops to develop a Desired Future Condition model of the Eglin landscape in the fall of 2000. The information provided above may assist Eglin managers in identifying and prioritizing target communities on Eglin for desired future condition work and for future monitoring. In these workshops proposed conservation targets (natural communities, rare plants and animals) will be chosen and management goals for these targets established. Defining more specific management objectives for each target, including desired target condition, distribution and abundance (for example, vegetation structure, population sizes, etc.) will be a major goal in these workshops. The final list of targets should be designed to efficiently capture the greatest amount of rare and native biodiversity on Eglin. The eight natural communities proposed above for high priority status in the initial stages of the monitoring program may help achieve this goal.

TASK 4: ADDITIONAL DUTIES

Additional duties of FNAI are serving on the Ecological monitoring team for botanical and plant ecology issues. This included attendance at meetings and workshops when requested by Eglin staff, assistance to staff on plant identification, monitoring designs, and natural community management. Work accomplished:

* FNAI met with TNC Public Lands office in Gainesville to review Eglin Ecological Integrity Project file history and gain an understanding of the issues from the authors of the Hardesty, *et al.* 1997 document. November 1998.

* Attended an Eglin Natural Resources Planning team meeting as orientation to planning issues related to ecological monitoring. November 1998.

* Attended TNC longleaf pine management workshop November 1998.

* Participated in the TNC Fire Dynamics Model Workshop at Eglin. February 1999.

* Coordinated transfer of Eglin ArcInfo Vector landcover map data to the Ecological Monitoring team's remote sensing staff member Steve Laine, and discussed with Mr. Laine the need for use of remote sensing work in the Tier IV areas. Also discussed with Mr. Laine and Mr. Christianson possible priorities for the remote sensing position. FNAI suggested that high priority be given to developing the ability to remotely detect and measure severity of oak encroachment and sand pine encroachment in sandhills on Eglin. FNAI suggested the groundtruth data from the tier map may be useful to this end. (984 ground truth points).

* Attended a meeting of natural resources managers from Fort Benning, Camp Lejune and Eglin at Jackson Guard to learn of monitoring and mapping programs at these installations. February 1999.

* Attended presentation of LL pine Restoration Project annual results. April 23.

* Participated in the June TNC workshop "Vegetation Monitoring in an Ecological Context" in Crossnore, N.C.. This was a week long, intensive course in monitoring design, statistical and sampling methods for land managers, primarily designed for the U. S. Forest Service.

* Met with Doria Gordon and Louis Provencher regarding development of management and sampling objectives for ecological integrity metrics.

* Met with Tim Christiansen and Eglin land managers to attempt to develop management and sampling objectives for all ecological integrity metrics, at the request of Doria Gordon (August 1999).

* Designed sampling program for monitoring impacts of sand pine removal on wiregrass for Scott Hassell (Appendix C). November 1999.

* Attended Ecological Monitoring Team meetings in June 2000. Presented results of sandhill groundcover metrics at one of the meetings.

KEY RESEARCH ACCOMPLISHMENTS

- Design, implementation and analysis of the first base-wide test of potential groundcover indicators of sandhill ecological condition. Developed monitoring protocols, determined time/effort estimates, sample size estimates, and determined which groundcover variables measured are effective at indicating sandhill condition with respect to mapped Tiers of ecological condition. Proposed a list of groundcover variables to incorporate into future monitoring.

- Developed a prioritized list of rare plant species recommended for inclusion in the monitoring program. Species were classed into 8 priority groupings that should receive one of three basic levels of monitoring. This approach significantly reduces the amount of time and effort needed for rare plant monitoring on Eglin, while at the same time capturing the most important rare plant diversity the base harbors.

- Developed detailed monitoring plans and protocols for *Cladonia perforata* and *Matalea alabamensis*. Collected baseline data for *Cladonia perforata*.

- Ranked Eglin's 34 natural communities according to rarity, importance to rare species and biodiversity, and degree of threat. Eight communities were proposed for high priority status for monitoring condition and threats. Metrics for monitoring the condition of these communities were proposed.

REPORTABLE OUTCOMES

There are no reportable outcomes, as described in the Format Requirements for Preparing Reports.

CONCLUSIONS

The work under Task 1 represents the first base-wide test of potential indicators of sandhill ecological condition. This task confirmed the usefulness of some groundcover variables as indicators of ecological condition, while other variables clearly should be discarded. The results also point toward the need for a revision of the Tier 1 sandhill criteria, and indicate that features of groundcover in FNAI sandhill element occurrences may indicate how best to do this. Further collection of groundcover data and the incorporation of all vegetation strata into a single sandhill monitoring program is recommended. This task also illustrates a flexible, robust base-wide sampling design that may be applied as is, or in a modified form, to future sandhill vegetation monitoring.

FNAI narrowed the list of rare plants known to occur on Eglin to 32 species recommended for inclusion in the monitoring program. These were classed into 8 priority groupings that should receive one of three basic levels of monitoring. This approach significantly reduces the amount of time and effort needed for rare plant monitoring on Eglin, while at the same time capturing the most important rare plant diversity the base harbors. Examples of two monitoring plans for two rare species were developed.

Although it is likely that all, or most, natural community types on Eglin will become conservation targets in an upcoming Desired Future Condition workshop, it is still important to prioritize community types in order to effectively implement a monitoring program. FNAI reviewed the list of 34 community types on Eglin, ranked them according to rarity, importance to rare species and biodiversity, and degree of threat. FNAI then selected eight communities that representing both small patch and matrix types to receive high priority at the beginning of the monitoring program. FNAI put forth preliminary list of metrics for use in monitoring the condition, or threats to the condition, of these eight communities.

Through out the year FNAI served as botanical and plant ecology staff for the Eglin monitoring program, attending meetings, reviewed documents and provided consultation to staff on plant idenfication, vegetation mapping, and development of objectives for the monitoring program. A major conclusion drawn from this experience is that the Eglin monitoring program needs a full-time plant ecologist or botanist on staff in Jackson Guard, to fulfill at least part of this role. FNAI hopes to continue to work with Eglin on the monitoring program, particularly with respect to rare plants, animals, and non-matrix communities. Large-scale community monitoring, particularly that of sandhills, flatwoods, and upland pine systems that are integral to the forestry program at Eglin, need to be integrated into forestry or fire effects monitoring programs that are ongoing. The statistical and botanical expertise necessary to accomplish that type of large-scale, multi-variate monitoring and analysis should be added to Eglin staff.

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Appendix A

Original monitoring design and sampling objectives for sandhill groundcover metrics. The original designed was later changed by Eglin staff. The final monitoring design is described in report text to which this appendix is attached.

MEMORANDUM

Florida Natural Areas Inventory
1018 Thomasville Rd., Suite 200-C
Tallahassee, Fl 32303
(850) 224-8207 phone (850) 681-9364 fax

To: Rick McWhite
Steve Seiber
Carl Petrick
Tim Christiansen
James Furman

Cc: Jeff Hardesty
Doria Gordon
Louis Provencher

From: Carolyn Kindell

Date: May 6, 1999

Subject: Sampling design for sandhill groundcover

During our meeting of Feb 2, FNAI agreed to present one or two monitoring designs for the sandhill understory plant metrics for your review. At that meeting we discussed the possibility of stratifying the sampling design by management units (such as burn units), and the need to integrate field work for many metrics to avoid duplication of field effort. FNAI was to send the designs to Tim, who will incorporate them into the overall monitoring program. I have informally presented the information below to Tim.

Louis Provencher did most of the work for this sampling design, which is based on the Longleaf Pine Restoration Project's data and his power analysis for sample sizes. He and I are still choosing the final list of metrics and threshold values that will trigger management action. However, we have decided on a sampling design that can accommodate any groundcover metric we choose.

Louis and I considered two design options for monitoring sandhill groundcover metrics: 1) randomize sampling, and 2) nested sampling by management units.

We recommend a randomized sampling design across all sandhills on Eglin. This design provides the greatest flexibility in data analysis and efficiency in data collection. We will randomly pick quarter-sections (from USGS Township, Range, Section), which become our basic sampling unit. Within each quarter section, we collect groundcover

data from four 0.5 m X 8 m sub plots, which will be averaged for a mean value per quarter section. The quarter-sections will be permanent over years, but the 0.5 m X 8 m subplots will be redrawn every year.

Louis' power analysis has determined that 300-500 quarter-section samples are needed to adequately sample the groundcover metrics across Eglin sandhills. This sampling design would allow the detection of a ±20% change in the mean of most metrics with 95% confidence. We are still working to choose the final metrics (species and variables) that will allow us to have the smallest sample sizes possible. We also believe that a 1-2 year data collection cycle is necessary for groundcover metrics.

We considered the alternative, nested or stratified (depending on how management units are defined) sampling within management units, but determined that random sampling is a far better approach. Nested or stratified sampling requires a much greater level of sampling effort (eg. greater than the 300-500 samples proposed above!), and limits the ability to analyze the data (less information value per sampling effort) because there would be too few management units to either perform ordination statistics or paired t-tests. Management units are not the homogeneous statistical units they need to be for nested or stratified sampling. Nested or stratified sampling within the 12 Ecological Management Units, for example, would greatly limit analysis of the data base-wide and comparisons among the units because only 12-1=11 degrees of freedom would be available.

The random sampling design is more statistically powerful. It will allow us to use several different statistical techniques to view the sandhill groundcover data in a variety of ways, including segregated by management units. For example:

- We can compare metric values among the 12 ecological management units, or among other large units such as watersheds, because several of the 400 to 500 sample points are bound to fall into each management unit.

- We can show potential "problem" areas on the base (where groundcover metrics are below or above certain threshold values), by using ordination to cluster ecologically similar samples together. For example, the groundcover metrics are supposed to reflect levels of soil disturbance and fire suppression, so we should be able to group like samples together, showing areas where there are high levels of these disturbances.

- We can get summary data by management unit by simply tabulating values from quarter sections that fall within each management unit.

- We can provide a single, base-wide measure of groundcover metrics that may be compared year to year.

Incorporation of Reference areas into statistical design

To the 300-500 randomly sampled units for sandhills we will choose additional sampling units in reference areas (likely an additional 50-100 units). These data will allow us to compare all Eglin sandhills to reference condition, showing samples "like" and "unlike" the reference samples. These comparisons can be performed with ordination methods, discriminant function analysis, or less conventional methods as presented in the Longleaf Pine Restoration Project 1999 annual report (i.e., similarity analyses). Louis will help guide the monitoring team through these analyses.

The next steps

We strongly recommended that Jackson Guard unify monitoring for other sandhill metrics under a single sampling design. Other metrics include sand pine abundance, hardwood abundance, LL pine size structure, and old growth mortality. **We recommend that the proposed random sampling design for groundcover plants provide the basic framework for other sandhill metrics monitoring.**

I understand from Tim that monitoring designs for hardwoods and pines are on hold until FMIS data are fully computerized. If all sandhill vegetation monitoring is to be integrated into a single design, then I am concerned about embarking on data collection for groundcover, without knowing if this design will work with Tim's final design for the midstory and trees.

Please provide instruction to me on how to proceed. I see two basic alternatives.

1) If you approve the proposed groundcover monitoring design, FNAI/TNC could move forward with data collection for understory groundcover metrics without collecting tree and midstory data. This could provide cost and feasibility estimates for the random sampling design. However it may not be worthwhile if this design will be changed as it is integrated into the overall ecological monitoring program.

2) If you wish to wait until the groundcover sampling design is integrated into the overall sandhill vegetation monitoring, then FNAI/TNC will complete the choice of sandhill ground cover metrics and sample sizes, and then put data collection on hold. FNAI will then focus on the other metrics for which we are responsible: rare plants, non-sandhill natural communities, and vegetation cover change on Eglin.

Please call me 850-224-8207 or email me at ckindell@fnai.org with any questions or instructions on how to proceed. I will be happy to travel to Jackson Guard to discuss whenever it is convenient for you.

Eglin AFB

Management and sampling goals and objectives for sandhill groundcover.

Management goals

1) **(General)** Restore groundcover in all sandhills at Eglin to reference condition, in structure and composition.

2) Achieve fire maintenance condition in the groundcover of all sandhills at Eglin. (fire maintenance condition = controllable fire can occur at any time of year, with groundcover structure and species composition that reflects a frequent fire regime).

3) Achieve low impact of soil disturbance in all sandhills at Eglin.

4) Over a 5 year period, demonstrate a trend in the groundcover indicators of soil disturbance and fire suppression across Eglin sandhills toward the threshold levels found in reference areas.

Monitoring Goals

Track progress toward management goals for fire-suppression and soil disturbance in Eglin sandhills, by tracking indicators of these conditions on a yearly basis, Eglin-wide and by Ecological Management Units.

Groundcover Condition	Indicator (metric)
Soil- disturbance	Hypericum gentianoides density
	Woody vines density
	Legume density
	Vaccinium darrowii density
Fire-suppression-	Graminoid density
	Solidago odora density
	Dichanthelium spp. density
	Total herbaceous cover
	Total woody cover < 1m in height

Note: The four sandhill groundcover metrics originally proposed in Hardesty, et. al (understory forb density, graminoid density, soil disturbance-sensitive taxa, and fire suppression-sensitive taxa) were modified based on most current data from the Longleaf Pine Restoration Project. The final metrics are rolled into a single sampling design.

Management Objectives for sandhill groundcover:

1) Over a 5 year period demonstrate a trend in the densities of the following indicators of fire suppression across Eglin sandhills toward the threshold level found in reference areas. Trends for 3 of the 5 indicators should be measured with sufficient precision to detect a 20% change in each indicator. This enables land managers to report progress toward the goals to the General on a yearly basis.

Indicator	**Threshold level**	**Increase/decrease w/ fire**
Graminoid density	XX clumps/m2	increase
Solidago odora	XX individuals/m2	increase
Dichanthelium	Xx individulals/m2	increase
Total herbaceous cover	XX% cover/m2	increase
Total woody cover <1m	XX% cover/m2	decrease

2) Over a 5 year period demonstrate a trend in the densities of the following indicators of soil disturbance across Eglin sandhills toward the threshold level found in reference areas. Trends for 2 of the 4 indicators should be measured with sufficient precision to detect a 20% change in each indicator. This enables land managers to report progress toward the goals to the General on a yearly basis.

Indicator	**Threshold level**	**Incr/decr w/ time since dist**
Woody vines	XX stems/m2	decrease
Legume density	Xx individuals/m2	increase
Hypericum gentianoides	XX individuals/m2	decrease
Vaccinium darrowii	XX individuals/m2	increase

Sampling Objectives:

1) Across all sandhills on Eglin, with 90% confidence and 90% power, detect a 20% change in densities of the indicators of groundcover fire-suppression: graminoids, total herbaceous cover, and total woody cover < 1m, and indicators of soil disturbance: woody vines, and legumes.

2) Estimate those indicators within reference areas on Eglin within 20% of the true mean, with 90% confidence. This sets the threshold values for those indicators.

3) Collect density data for the indicators: Solidago odora, Dichanthelium spp., Hypericum gentianoides, Vaccinium darrowii.

4) Graphically compare estimates of all indicators among Ecological Management Units (watershed-based) and reference areas.

Appendix B

Sandhill groundcover indicators field sampling protocol

Protocol for sampling sandhill groundcover indicators for Ecological Monitoring Pilot project

I. **Pre-field work**

A. Locate areas (quarter sections) to be sampled on USGS topographic maps or aerial photos if provided.

1. Note if sampling area falls in a closed area using Eglin AFB map. If so, locate and record location from ROCC block map (e.g. Kilo 25, Bravo 13, etc.)
2. Check tier overlay map for specific location of tier to be sampled

C. Have several areas lined up to visit before calling for Z-clearance

B. Keep GPS unit (both batteries and data logger) charged nightly for 10-12 hours (more if necessary)

II. **Field work**

A. Getting to the right spot

1. Use aerial photos and/or topographic maps to locate landmarks, such as roads or other access points leading into the quarter section
2. Aim for the middle of the target polygon/sandhill type. Make sure to be aware of the assigned tier classification of sample if more than one tier occurs in the quarter section. Also avoid other community types and pine plantations (Only sandhills should be sampled).
3. If entering quarter section from a section border, walk into target polygon approximately 100-300 steps (50-150 paces) to the approximate center of the target sandhill type. This spot will be the starting point.
4. If already near the middle of a target, use this location as the starting point.
5. Use a random number table to determine the bearing and distance to travel from starting point. Do not use the starting point for the positon of the first subplot. Always be sure to randomize first.
   a. Randomly select a number from 1-360 for the direction to travel from starting point (using a random number table)
   b. Randomly select a number from 1-99 for the distance in steps to travel from starting point.

6 Walk direction and distance indicated by random number table. Use a compass.

a. If direction of path crosses a road, do not count steps while crossing road. continue counting steps indicated by random number table once beyond road

b. Travel in a straight line as best as possible. Thick vegetation may be avoided by walking parallel to obstacle until clear then continuing with last recorded step in the same direction as before. However, this may only be done toward the beginning of the indicated direction.

IMPORTANT: <u>The final few steps must be true to the randomly selected direction.</u> **DO NOT ATTEMPT TO AVOID ANY THICK VEGETATION TOWARDS THE END OF THE RANDOMLY SELECTED DISTANCE.**

B. Data Collection

1. Once you arrive at first sampling point (1st subplot of the quarter section) assemble sampling frame flat on the ground.
2. Frame should be oriented in the same direction that was followed to arrive at sampling point. In certain cases (i.e. where it appears that the transect will approach or cross a road), the direction of the transect may be run 180 degrees from the randomly selected direction used to arrive at start of transect
3. Take a GPS recording.
   a. Stand behind sampling frame (facing the direction of transect).
   b. Turn on data logger
   c. Select DATA COLLECTION from startup menu You may have to wait until GPS satellite connection is established (approximately 5 seconds).
   d. Select CREATE ROVER FILE
   e. Menu should appear titled CREATE FILE. A rover file name is given (e.g. R111822, corresponding to the date). This menu allows you the option of changing the file name if you wish. Make sure DATA DICTIONARY is set for EGLIN SANDHILL. Hit the ENTER key.
   f. A menu titled ANTENNA OPTIONS should appear with the following choices. Make sure ANTENNA HEIGHT is set at 2m. MEASURE should be set for VERTICAL. CONFIRM should read PER FEATURE. TYPE should be on INTEGRATED GPS/BEACON. PART NUMBER is 29653-00. Hit ENTER.
   g. START FEATURE menu should appear. Select GROUNDCOVER TRANSECT.
   h. ANTENNA OPTIONS menu reappears with the same information as before. Hit ENTER.
   i. GROUNDCOVER TRANSECT menu appears. Enter information on Township, Range, Section, Quarter Section, Surveyor, Field Tier Assesment, number of plots without sandhill vegetation and subplot number.
   j. A minimum of 4 satelites is needed to record position If there is difficulty in collecting points, move into an area with a more open overstory.
   k. Collect 20 points (usually 20-30 seconds elapsed time).
   l. Pause logging point by pressing F1 key.
   m. Ready to record to data
4. Recording densities of selected species
   a. Graminoids
      i. Count all grasses and graminoids (grass-like plants) including, but not limited to, *Bulbostylis spp., Carex tenax, Cyperus retrorsus, Cyperus filiculmis, Rhynchospora grayii,* and *Rhynchospora megalocarpa.*
      ii. Count graminoids as separate plants if there is a distance of 5 cm or greater between individual plants.
   b. Woody vines
      i. Woody vines include species of *Smilax* (primarily *S. auriculata*), *Gelesemium sempervirens* (Yellow jasmine), *Rubus spp., Vitis spp.* and *Clematis reticulata. Smilax pumila* (typically a mesic and secondary woods

species) may rarely be encountered and is not treated as a woody vine.
ii. Count woody vines as separate plants if stems are not joined together underground (Should only have to dig down a maximum of 2 cm).

c. *Solidago odora* (SODO)
d. Legumes
i. Count and record all legumes rooted in the plot
ii. Count all legumes at base. Count all individuals as separate plants if not joined together underground (dig down a maximum of 2 cm).
f. *Vaccinium darrowii* (VADAR) Count from base
g. *Hypericum gentinoides* (HYGEN)

5. Catergories of densities
a. 1-5 individuals
b. 6-10 individuals
c. 11-25 individuals
d. 26-50 individuals
e. 51-100 individuals
f. 101-150 individuals
g. > 150 individuals
6. Record cover of selected groups (Herbaceous, woody, and total coverage)
a. Woody cover includes all plants that are woody and less than 1 meter tall (including woody vines).
b. Plants (woody or herbaceous) not rooted in the plot but hanging over sampling area should be included in the appropriate groups as well as total cover
7. Categories of percent cover
a. 0 %
b. 1-5%
c. 6-25%
d. 26-50%
e. 51-75%
f. 76-95%
g. 96-100%
8. Repeat data collection steps 4-5. Make sure to follow the direction of the randomly selected bearing. THIS PROCEDURE WILL BE COMPLETED FOR TRANSECTS 1A-1D, 2A-2D, 3A-3D, and 4A-4D.

III. **Post field work**

A. Plan for next field day (see I. Pre-field work above)
B. Transfer files from data logger on a weekly basis.

Appendix C

Sampling design for wiregrass in a sand pine removal plot.

FLORIDA NATURAL AREAS INVENTORY

1018 Thomasville Road, Suite 200C, Tallahassee, Florida 32303 (904) 224-8207

MEMORANDUM

To: Scott Hassell, Tim Christiansen
From: Carolyn Kindell
Date: November 23, 1999
Subject: Design for wiregrass monitoring in sand pine removal

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Below you will find my suggested sampling design for the sand pine removal area. Attached is a schematic drawing of the sample plot locations, with all distances shown by numbers (not to scale). Tim, please review and let Scott know if you think this design is ok, or what modifications you think are necessary.

I spoke with Louis about the design. He recommends that:

1. The sample plots should be permanently marked, as they were in the TNC study. Bill Caddell is familiar with how to do this.

2. One wiregrass clump per sample plot should be flagged to get an estimate of individual survivorship before & after logging. (This is in addition to estimating wiregrass density across the site which is the main purpose of the monitoring. The density estimate should be done by sampling design I present below).

3. A control should be established. This is to insure that some major climatic event is not influencing wiregrass density changes that may be seen in the sand pine removal area. The control area should be nearby, and have wiregrass in comparable densities, but it does not have to be exactly like the removal area. Louis even suggested that on the west side of the road, where logging has already occurred, might be ok, if a site exactly like the present removal cannot be found nearby. The control should be sampled at the same time the sand pine removal area is sampled.

Once you have found a control area, you can follow the basic procedures I outline below to create a sampling design for the control. If you need help with this or want me to review your design, let me know.

Management/monitoring Goals: I understand your monitoring goal is to assess the impacts of a sand pine removal operation on wiregrass density in the area where wiregrass is presently most abundant. This area you delineated on a photograph and gave to me.

Because we are interested in detecting a change in wiregrass densities, I set the detection limit at 20% change. So, we will aim to detect anything greater than a 20% change in wiregrass by comparing density before and one-two years after the sand pine removal.

Sampling objectives: In this first year, we want to be 90% sure we have estimated wiregrass density within 20% of the true mean.

One/two years after sand pine removal, we want to be 90% sure of detecting a 20% change in wiregrass density, with a false-change error rate of 20%. That is, we are willing to accept a 2 in 10 chance that we'll say a change took place when it actually didn't.

Note: We will use the pilot data to determine how realistic these objectives are, so they may change somewhat. However, we need to establish these objectives so that we know what we're aiming for. If you want to alter the objectives to make them fit better with your land management goals, go right ahead. At the moment, it will not change the pilot sampling protocol.

Sampling design (see attached diagram)

Steps I used to create this design:

I delineated a sampling area that covers most of the area Scott delineated. The west boundary is the road, the east boundary is roughly parallel to it about 260-300 m east. The sample area should not include the wiregrass on the creek slope, but should capture the wiregrass on the relatively flat area within the removal.

Using ArcView, I roughly estimated the length of the sampling area to be 540 meters from N to S. The width of the area varies from 260-300 meters. I evenly divided the sample area from N to S into ten, 54m wide segments, then randomly picked three transect locations within each segment. I ran the transects E-W so that if there is slope associated with the creek, the transects, for the most part, should run perpendicular to the slope.

Along each transect I randomly picked a sample location between 0 and 300 m. At these locations we will locate a 0.5 x 8 m sample plot, shown as little squares on the attached sheet.

Within each plot, all wiregrass clumps should be counted. Clumps separated by at least 10 cm should be counted as separate individuals. Clumps bisected by the plot boundary, but rooted in the plot, should be counted as "in". I find it easiest to count plants within a 0.5 X 2m subplots strung end-to-end to make up the 8 m length.

The thirty 0.5 x 8 m samples will constitute the pilot data we will to calculate how many additional sample plots are needed to achieve our objectives. The data you track along with wiregrass counts for each sample should include a unique identifying number for each sample, its sample section number, transect, and distance along transect. It would be good to also to mark the plot in the field with its identifying number.

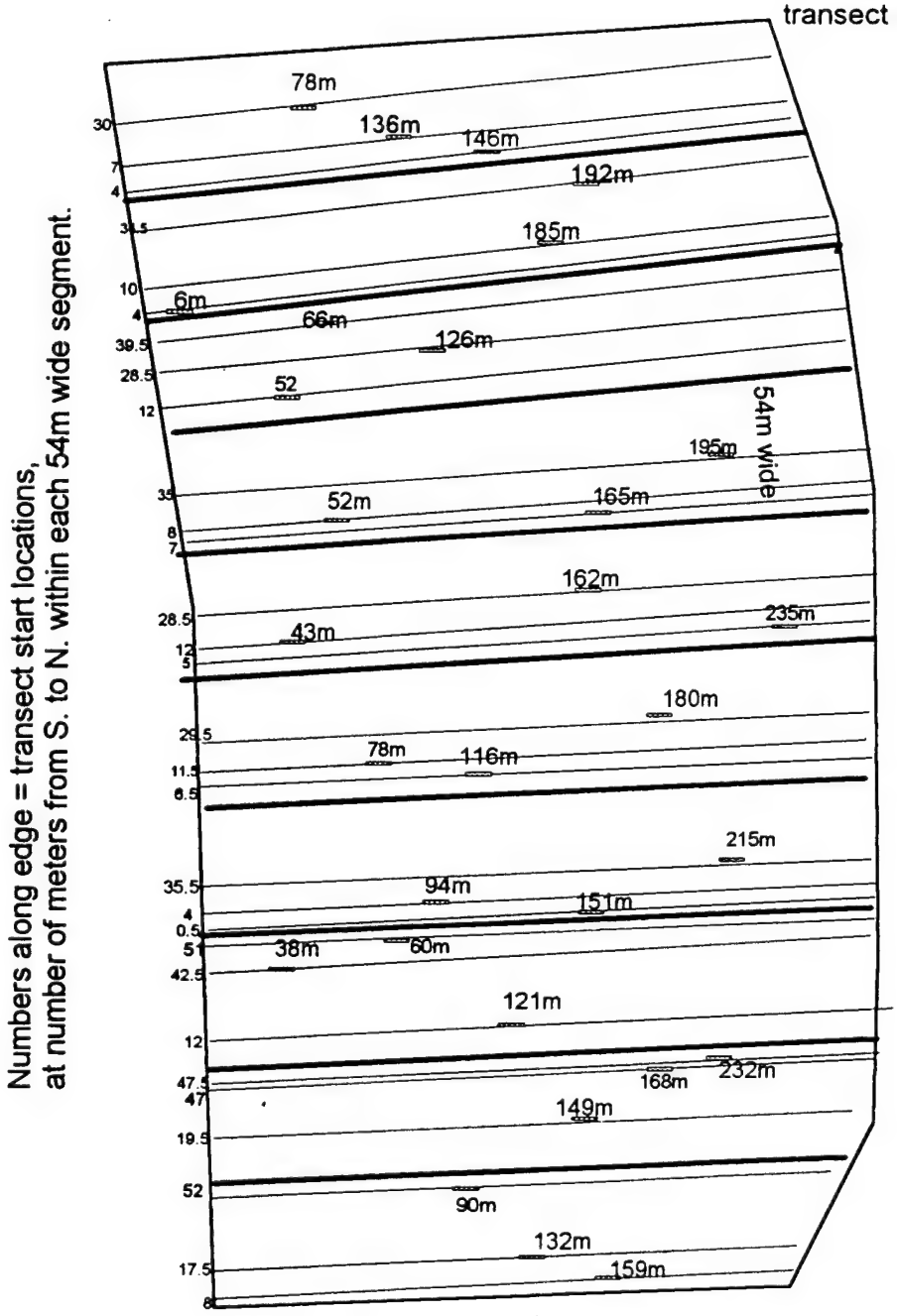
Good luck! When you are ready to start sampling, I will be happy to come over and go over sampling protocols in the field. If you have concerns in the field while setting out the plots, please let me know. Remember all sample plots should be located in the area where logging is to occur - not on lower creek slopes. If, for some reason, the location of a plot or transect I've indicated on the diagram is not appropriate, you can randomly choose another location within that section.

Cc: Louis Provencher, Doria Gordon

Wiregrass sampling design. All numerals represent meters.

0.5 X 8 meter sample plots randomly placed along transect.
transect lines randomly placed within segment
ten equal width segments (54m wide)
Sample area

Numbers by sample plots = meters from transect start at west end.



Note: not to scale

Appendix D

Monitoring plan for *Cladonia perforata*

FNAI monitoring plan for **Perforate Reindeer Lichen** (*Cladonia perforata*)

INTRODUCTION: The area occupied by the core population of perforate reindeer lichen on Okaloosa Island (=the eastern end of Santa Rosa Island) reported by Johnson in 1989 was reduced by over 60% after Hurricane Opal struck on 4 October 1995 (Yahr 1997). Reduction of the core population was on its southern and eastern edges by storm overwash from the Gulf of Mexico, and on its northern edge, by high water, either from heavy rains accompanying the storm or by salt water flooding from storm surge. Perforate reindeer lichen in the affected areas was washed into shrubs and trees and deposited in driftlines. Placing pieces of lichen that had undergone this displacement back on the ground was tried experimentally in one area on Okaloosa Island east of the road to the beach club (Yahr 1997). Of the 100% lichen cover in 1 m^2 and 0.2 X 0.5 m^2 experimental plots set up by Yahr and Franklin, only scattered pieces of lichen survived four years after the storm (Johnson *et al.*, 2000). The two small populations of perforate reindeer lichen known from the restricted portion of Eglin Air Force Base on Santa Rosa island were heavily impacted by Hurricane Opal --no perforate reindeer lichen was found at either site in a November 1999 survey (Johnson *et al.* 2000). Rebecca Yahr, a graduate student in the Botany Department at Duke University, Durham, NC (tel #: 919/660-7362), introduced the lichen into marked plots at these two sites in June 2000. She will monitor these plots for the next several years.

The goal of the monitoring plan presented here is to follow the natural lichen populations that remain on Okaloosa Island to periodically survey historical localities for recovery.

THREATS AND POSSIBLE MANAGEMENT RESPONSES (Threat--Response):

- 1) Storm overwash -- re-introduction in same or suitable nearby site
- 2) Flooding by heavy rains or storm surge -- re-introduction in same or nearby site
- 3) Sand burial -- planting sea oats or introducing sand fencing to stabilize sand seaward of lichen
- 4) Trampling by beach goers-- fence off areas and post signs forbidding "walking on sensitive areas where vegetation is recovering following hurricanes"; providing "porta-pottys" at beach access areas so beachgoers are not tempted to use the scrub areas for cover (foot trails were particularly noted around eastern base of the "Big Dune" at western edge of lichen area on Okaloosa Island).
- Off road vehicles driving through habitat on north side of US98 -- control vehicle access with fencing, as has already been done in several cases.

MONITORING OBJECTIVES: Detect a decrease in number of lichen patches in areas 1-5, or a substantial decline in patch size in 20% or more of the patches in area 1. Detect stabilization or continuing decease in number of patches following management actions taken to stem the loss. Search for new lichen patches that may be colonizing that portion of the area formerly occupied by lichen which still supports stable vegetation and enter GPS location of any new patches in Eglin rare plant database. Support experimental introduction of lichen to the two former sites on the restricted portion of Santa Rosa Island.

THRESHOLD FOR MANAGEMENT ACTION: If lichen is present at fewer than 100% of marked monitoring points, or its size class has remained stable at fewer than 80% of marked points (area 1), determine which threat is operative and take recommended steps.

AREAS TO MONITOR AND FREQUENCY:

- Areas 1 through 5 of core population on Okaloosa Island (map 1) - yearly
- Area 6 formerly occupied by lichen where lichen was re- introduced (by Yahr and others) in marked plots (map 1) - yearly
- Area 7 formerly occupied by lichen (map1) - search every 3 years to see if lichen is re-colonizing.
- Two areas on the restricted portion of Santa Rosa Island formerly occupied by lichen where lichen was re-introduced in marked plots on 6/2000 by Rebecca Yahr (map 2) - yearly after Rebecca Yahr finishes project.

MONITORING METHODS:

Work done to date - Area 1. FNAI marked all of the clumps of *Cladonia perforata* found in Area 1 (Map1) with red wire flags on June 2, 2000. Each flag was numbered consecutively with black marker pen. If several lichen clumps were in the same vicinity, only one flag was used to mark all of them and the number of clumps within sight of that flag was noted. At each flag lichen clumps were placed into three size classes: less than 1 square foot of continuous cover = small patch; greater than 1 square foot continuous cover = large patch, and non-continuous cover = scattered thalli. Twenty-nine red wire flags were used to mark a total of 62 patches of lichen found in Area 1 (Table 1). These 62 patches consisted of 6 small patches, 43 large patches, and 13 instances of scattered thalli. After all clumps were flagged, FNAI walked a U-shaped path through Area 1 from the parking area at A-2, west along the north side of the scrub to the "big dune", then south across the scrub to the north edge of the sea oats dunes bordering the beach, and then east along the south side of the scrub back to the road to A-2 (Map1). This route was chosen for ease of access, to minimize damage to existing vegetation, while maximizing the number of flags encountered. The numbers of all flags that were encountered along this route were noted for monitoring, as well as the size class of the lichen clump nearest the flag (baseline size class). A descriptive narrative of the route walked was created to aid future surveyors in finding the flags, using the telephone poles along US98 for orientation. Of the 62 patches noted in the complete survey, 21 were encountered in walking this route (Table 1). Of these, 3 were small patches, 15 were large patches, and 3 were scattered thalli. Monitoring entails following the same route by reading the narrative; at each numbered flag (or permanent marker that may be substituted) the investigator notes on the datasheet whether the lichen is present=1 or absent=0, and whether it is still in the same (or larger) size class=1 or has shrunk to a smaller size class=0 (see field datasheet on p.11). The purpose of this monitoring is to detect if patches of the lichen are being eliminated, or seriously declining, anywhere in this area , as well as to detect whether the loss of patches (or serious decrease in size of patches) has been halted or reversed after any management actions are taken.

Work remaining to be done - Area 1.

Step 1 - Assemble materials needed:

- ½ inch PVC pipe in 5 ft lengths with small holes drilled near top for tag attachment (or other type of permanent stake chosen to mark the patches)
- numbered metal tags and wire cut in 4 inch lengths to attach tags to stakes
- hammer for pounding in stakes
- GPS unit
- topographic map (Fort Walton Beach) and recent aerial photograph of area if available
- narrative of directions to marked photo plots (pp. 7-10 of management plan)
- blank datasheets (p.11) and pen

Orientation is aided by counting the telephone poles along US98, with the pole west of the road to A-2 as pole #1 and the pole on the big dune as pole # 8. Pole # 8 can be distinguished as the one to which the wires slant upward (the wires are level between the other poles).

Step 2 - Permanently stake and number data collection points and take data.

To do this, park at A-2 installation and note the first telephone pole west of parking area as pole number 1. Following narrative for Area 1, walk west in low area on north side of scrub to first red wire flag (#4) between telephone poles 3 and 4 as indicated on narrative. Flag #4 is noted as marking a large patch of linear shape that continues west to Flag #8. Hammer in permanent PVC pipe in position of Flag #4 to permanently mark this point. Attach numbered metal tag and note number on datasheet. Record on datasheet whether lichen present or absent and whether size class is same or smaller. Go to next numbered flag in narrative and repeat procedure until all are done. Make pencilled notes on narrative to improve directions to permanent stakes if needed.

Step 3 - Enter data into spreadsheet on computer.

Enter data from field datasheet to spreadsheet with formulas to calculate percentage of patches where lichen present and percentage of patches whose size class has decreased. If presence is less than 100% of marked points or patch size had remained stable at fewer than 90% of marked points, the source of threat should be determined and appropriate management action taken. A sample spreadsheet for three years monitoring data is attached (p.12).

Step 4 - Management action.

If threshold for management action is exceeded, determine specific cause of decline and what management response is required. Implement management response. Continue yearly monitoring to detect if action has halted or reversed decline. If decline continues, determine whether a different or stronger management action should be implemented.

Repeat steps 1-4 for Areas 2-5 by walking a line along the dune ridges (indicated by red lines on Map 1), and marking with permanent numbered stakes all lichen patches encountered (minimum of 20). Areas 2-5 are not perceived to be as threatened as Area 1, and thus it is thought that it would be sufficient to note just presence/absence of lichen at each point in those areas, rather than presence/absence plus patch size as in Area 1.

SUMMARY OF PROPOSED MONITORING ACTIONS:

A) Core population:

1) Area 1 (Map 1) - east of AF installation A-2 west to "big dune" south of US 98.

- follow loop walk with narrative fill out data sheet for permanently staked patches of *Cladonia perforata*.
- enter data to computer spreadsheet file and calculate percentage of marked patches present and percentage .

2) Areas 2-5 (Map 1)

- walk an easily accessible line along long dimension of each area (red lines on Map1) and mark lichen patches encountered as was done for Area 1, and create a narrative for each area. Monitor presence/absence of lichen at each numbered stake yearly.

3) Area 6 (Map 1) - east of road to beach club

- monitor any remaining plots set up post- Opal (Yahr 1997) for presence/absence of lichen.

4) Area 7 (Map 1) - low area of scrubby flatwoods interspersed with swales bounded by Santa Rosa Sound on the north, higher dune ridge along US98 on the south, the Coast Guard Station on the east, and a higher N-S running dune ridge on the west.

- search this area for occurrences of lichen every 5 years - mark any patches found with flagging and take GPS point for placing record on Eglin's GIS map.

B) Two former sites on restricted portion of Santa Rosa Island (Map 2):

- monitor Yahr's introduction plots in these two areas after she has finished her project (2002).

DISCUSSION:

Two other methods of monitoring the lichens besides the one outlined here were considered, but were determined to be too labor intensive for the return in precision gained. Taking photographs of the lichens in a quadrat (0.5 m^2) at each marked point was considered as a way to eliminate subjectivity in judging the size class of lichen patches. It was decided that the gain in precision would not offset the considerable extra labor and disruption to the habitat that photopoints would entail, including:

- two permanent stakes at each point in order to line up the quadrat in the same way each time, instead of one;
- extra time involved in carrying along photographs and a quadrat, orienting the quadrat along the permanent stakes, and comparing the lichen cover within the quadrat to a photograph at each monitoring point
- the possibility of inadvertently moving or fragmenting the lichen patch when placing a quadrat on top of it.

A second possible method of determining the amount of lichen present is the line-intercept method which involves stretching a meter tape between two permanently staked points and marking the lichen as present/absent along each meter of tape. This was used by Yahr (1997) to look at the range of habitats occupied by the lichen. Some advantages of this method are:

- it would require fewer permanent stakes,
- the transect layout could be randomized to provide unbiased coverage of the area the lichen occupies,
- and the data is reliable in that it would not require any subjective judgements of patch size.

The disadvantages are:

- it would require 2 people, thus doubling the amount of trampling in the habitat and
- it would in some cases necessitate trampling over shrubs and through lichen patches to get to the tape to note the meters where it crosses patches of lichen - also more disruptive than the narrated walk.

However, given its advantages, it may be that this method is worth a trial run, to see if indeed the disruption to the habitat is as much of a problem as it at first appears.

LITERATURE CITED:

Johnson, A. F., H. E. Horne, and C. E. Kindell. 2000. Status of rare plant and lichen species and natural communities on Eglin Air Force Base, Santa Rosa Island, Florida - 1999/2000.

Yahr, R. 1997. Recolonization and reintroduction of *Cladonia perforata* Evans, an endangered lichen, at Eglin Air Force Base, Florida. Final report for contract #3339 submitted to Florida Division of Forestry, Tallahassee.

Table 1. Total number of patches of *Cladonia perforata* marked in Area 1.

This is a baseline census of lichen population in Area 1 and chronicles the numbered flags set out by FNAI on June 2, 2000			
Flag # (*=to be staked)	small patch	large patch**	scattered thalli
1*			1
2*	1		
3			
4*			1
5		2	
6		1	
7		3	
8*		1	
9*		2	1
10*		1	2
11			2
11a			1
12*		1+5	
13*		4+4	
14*		1+2	
15*		1	
16*		1	1
17		1	
18		1	
19*	1		
20*	1	1	
21*		1	
22	1		
23			1+1
24*	1		
25*		2	
26*	1	1	1
27*		1+3	
28*		1	
29*		1	
30*		1	1
Total patches counted = 62	6	43	13
Total to be monitored=21	3	15	3
** - the "+" sign refers to patches within sight of, but away from the immediate vicinity of the marker flag.			

NARRATIVE FOR MONITORING CLADONIA PERFORATA IN AREA 1.

Narrative for walking the monitoring loop for Perforate Reindeer Lichen (*Cladonia perforata*) at area 1 of core population: south of US98 from A-2 west to Big Dune. AFJ 6/2/00
Abbreviations: CP=*Cladonia perforata*, CL= *Cladonia leporina*, CE =*Cladina evansii*, CS= *Cladina subtenuis*.

BEGIN along north edge of scrub starting just west of the road to A-2 and walking west in open dip parallel to ridge with fence along it adjacent to US98 right-of-way (white line of open bare sand visible in DOT aerial). Orientation is aided by counting the telephone poles along US98, with the pole west of the road to A-2 as pole #1 and the pole on the big dune as pole # 8. Pole # 8 can be distinguished as the one to which the wires slant upward (the wires are level between the other poles).

Pole 1-2
No CP. Large patches of CL on south side of trail.

Pole 2-3
No CP. Dense patches of CL just east of pole 3.

Pole 3-4
Between poles 3 and 4 (southeast of pole 4) encounter a cement survey marker on left inscribed "20 CA -A3...etc." - FLAG **#4** - one thallus of CP on ridge crest northeast of cement marker. Continue along ridge crest.

Large linear patch of CP continues from FLAG # **4**, west along south edge of oak scrub on crest of north ridge for ca 30 meters to FLAG **#8**, opposite pole 4.

Pole 4-5
CP continues west of pole 4 as scattered thalli with CL along south edge of shrubs on crest of ridge to FLAG **#5**. CP also is found in dip to south of crest in bare open sand around rosemary shrubs.

Continue west to large, dense patch of *Quercus geminata* (sand live oak) on north whose tops were killed back about 2 ft by salt spray; many small dead sand pines in dip to south- 2 large patches of CP are on north edge of dead sand pines at FLAG # **9**.

CP continues west along edge of dense *Q. geminata* patch north of trail, but not on south side of trail. As *Q. geminata* increases in height to 10-15 ft, CP diminishes and CL increases. CP ends about 20 m east of pole 5.

No lichen of any kind in shady oak hollow east of pole 5.

Pole 5-6.
West of pole 5, few scattered thalli of CP south of a second shady hollow in open sand around

rosemary shrubs FLAG # **10**.

10 m west of FLAG **#10** is a small patch of CP in path and scattered thalli continue south of path for 10 m.

Cross a major human access path (1-W) near a 5 ft white PVC pipe with orange sign " Warning: Underground cable" and a wooden sign post with sign ripped off. No CP here - bare moving sand with *Asclepias humistrata* (purple milkweed).

Continue west along crest of north ridge to pole 6 - all lichen is CL.

Pole 6-7
Continue west past pole 6 through bare sandy area with *Asclepias humistrata*. Pass a shady hollow on south side of trail with CE.

Pole 7-8

Cross second human access path (2-W) and third human access path (3-W) and stop. Pole 8 is on the north flank of Big Dune and the remainder of the way to it is occupied by grassy vegetation unsuitable for lichens.

Crossing to south leg of loop.
Turn southward parallel to base of Big Dune on second access path (2-W). One thallus of CP along trail. Trail forks - take left fork (right fork goes along base of Big Dune).

Continue through shrubs downslope to sandy opening. Trampled CP in trail, plus big patch to right of trail at FLAG # **12**. Five more large patches of CP in dip.

Continue south along trail to large E-W oval bare sandy area with no lichen. Follow tracks to right and pick up trail through low rosemary shrubs to dip. Four large patches of CP along trail at FLAG **13**.

Come to fork in trail and take left fork. Large patch of CP at FLAG **14**.

Pass large patches of CL on right before coming to debris pile remaining from wrack line deposited by Hurricane Opal. Sea oats dune behind beach visible beyond debris. Turn east.

Continue east down southern leg of loop.

Pole 7-6
Pass dense stand of spray-pruned oaks 3 ft tall. Large patch CP on crest of central ridge above wrack line at FLAG **15**. Prostrate sand pine seaward of flag. Scattered thalli of CP also on inland edge of wrack line.

Narrative for Area 1 (continued).

Continue east a few more m - another large patch of CP south of trail on edge of shrubs at FLAG **16**. Patch continues to north where trail goes between rosemary shrubs.

Continue east to large bare sand opening running E-W. CP is on west side of opening near shrubs and on north side in dip. Continue east into dip. Few thalli of CP at FLAG **19** where trail continues east between oak and rosemary shrubs.

Continue east. CL present on trail and to right of trail with CE. Continue upslope to small opening - all CL. Continue east through sand pine and dead rosemary shrubs to opening opposite pole 6 - all CL.

Pole 6-5

Continue east through shrubs to N-S opening. Large patch of CP to north surrounded by dead sand pines and living rosemary shrubs at FLAG **20**.

DETOUR?? to south??Pass small patch of CP to south. Clump of dead rosemary and sand pines north of sea oats dune. Gulf visible. Scattered thalli of CP and CL in wrack line debris. Return to inland trail at double bent pine snag.

Continue east to next opening - broken patch of CP to north at FLAG **21**. Cross human access path (4-E) through dead rosemary shrubs. Scattered thalli of CP to north on access path.

Trail curves north past scattered thalli of CP in wrack line. Cross second human access path (5-E). Shrubs very low here (2 ft tall). Continue through low rosemary shrubs. Patch of CL to north of trail and around dead sand pine with few thalli of CP mixed in. One small patch CP on debris pile at FLAG **24**.

Pole 5-4

Cross another human access path (6-E) opposite pole 5.

DETOUR to south?? Pass short dead sand pine to two large patches of CP at FLAG **25**. Walk over dead sand pine past mixed patch of CL and CP.

Continue east to open patch on crest with patch of Gulf bluestem grass (*Schizachyrium maritimum*). CL under rosemary shrubs.

DETOUR to south: Curve south past low sand pine to dip. Scattered thalli of CP in patch of CL. Dense stand of sea oats to south. One patch of pure CP in dip to east surrounded by rosemary shrubs at FLAG **26**.

Return to interior crest: all CL in opening just west of pole 4.

Pole 4-3

Narrative for Area 1 (continued).

Large bent pine snag on crest visible. Can see cars parked at A-2 from here (opposite pole 4).

Descend into dip past short 3 ft tall sand pine on north. On south side of trail are scattered thalli of CP mixed with CL.

Large patch of CP at base of dip at FLAG **27**. Three more large patches of CP are nearby, plus another large patch of CP to east surrounded by rosemary shrubs at FLAG **28**. CP here is growing with CE and CS. Two more similar patches of CP to southwest of this one.

Continuing east on crest is another large patch of CP surrounded by rosemary and sand pine at FLAG **29** (to north of patch at FLAG 27 and south of dead three-trunked sand pine).

Continue to large bent pine on crest in bare sand opening with no lichen. Continue east on crest past large patches of CL.

West of pole 3 the way east is blocked on crest by dense low patch of shrubs. Detour south off crest around shrubs. CL in dip.

Walk east below crest through dead sand pines though CE to opposite pole 3.

Pole 3-2
Head east into dip south of crest to large patch of CP at FLAG **30** (white paper stuck on twig).

Cross human access path from beach that dead ends in scrub.

Return to crest and a small patch of CP at FLAG **2**. Continue east through large patch of CE under dead sand pine.

Clamber south over shrubs to bare sea oats dune and continue east.

Pass rosemary shrubs being buried by sand and with and salt burn on their leaves. Return to central ridge.

Pass large patch of CL on crest just west of pole 2.

Pole 2-1
Continue east to one small patch of CP on crest FLAG **1**.

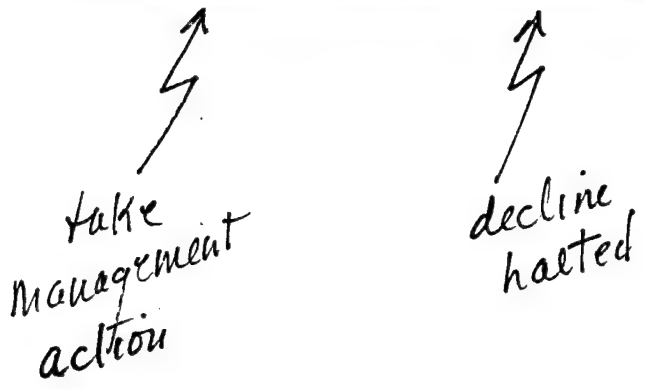
Continue east to A-2 road, past CL patches in dip to south. THE END.

SAMPLE DATASHEET

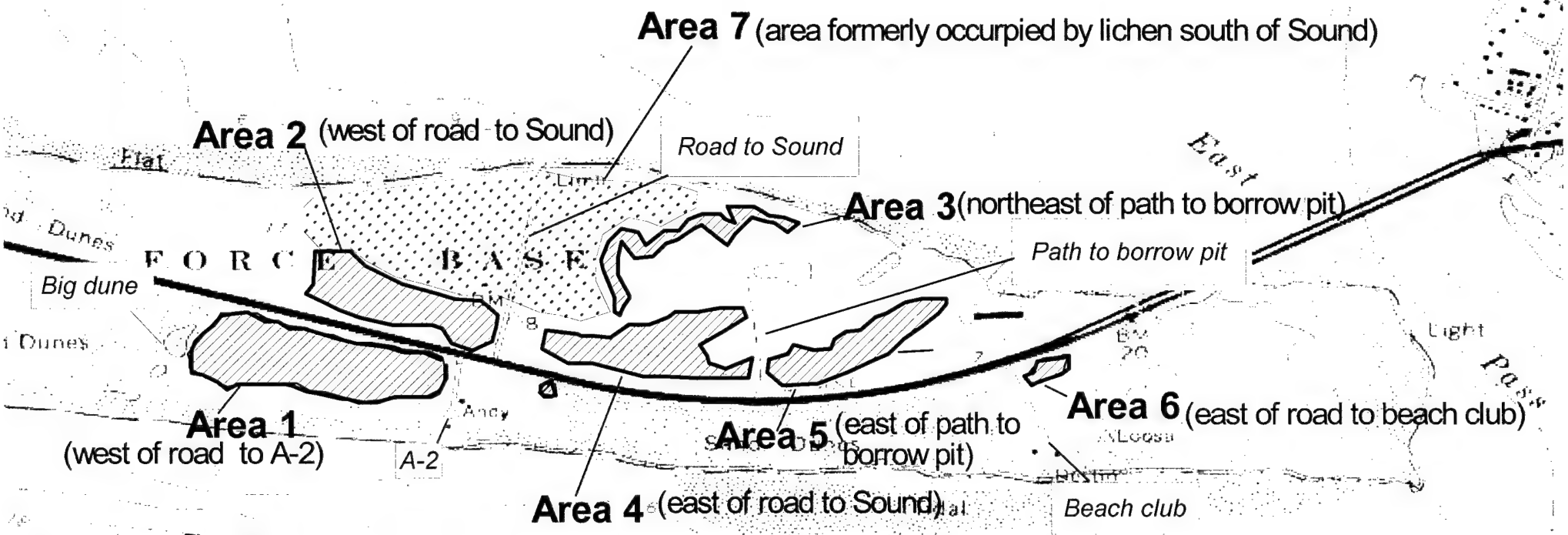
EGLIN RARE PLANT MONITORING DATA SHEET				Date:
SPECIES: ***Cladonia perforata***				Investigator:
SITE: **Okaloosa Island - area 1** (west of road to A-2)				
Baseline description: large patch (>1 square ft area); small patch (< 1 square ft area); scattered thalli (thalli not forming continuous cover) AFJ 6/2/00 [FOLLOW CLADONIA AREA 1 NARRATIVE]	# of red wire flag (written in black marker pen)	Lichen present? present=1 absent =0	Same size category? same or larger=1 Smaller=0	Notes on possible causes of decrease (soil disturbance, discolored thalli, crushed thalli, shading from growth of surrounding shrubs, increase in cover of other lichen species, etc.) CONTINUE ON BACK IF NECESSARY REPEATING FLAG # FOR REFERENCE
scattered thalli	4			
large patch	8			
large patch	9			
scattered thalli	10			
large patch	12			lichen trampled in human access path
large patch	13			
large patch	14			
large patch	15			
large patch	16			
scattered thalli	19			
large patch	20			
small patch (? - check)	21			
small patch	24			
large patch	25			
large patch	26			
large patch	27			
large patch	28			
large patch	29			
large patch	30*			
large patch	2			
small patch	1			
Human Access paths (if new path found, assign next number and make pencilled note of number in narrative at point where path crossed		Present? Present=1 Absent =0		
heading west	1-W			
heading west	2-W			
heading west	3-W			
heading east	4-E			
heading east	5-E			
heading east	6-E			
heading east	7-E			
.				
.				
.				
.				
.				

EXAMPLE OF SPREADSHEET WITH THREE YEAR'S DATA FOR CLADONIA PERFORATA

Eglin rare plant monitoring data - *Cladonia perforata* Area 1							
FLAG #	baseline size class	06/2001size	06/2001P/A	06/2002size	06/2002P/A	06/2003size	06/2003P/A
4	scattered thalli	1	1	1	1	1	1
8	large patch	1	1	1	1	1	1
9	large patch	1	1	1	1	1	1
10	scattered thalli	1	1	1	1	1	1
12	large patch	1	1	1	1	1	1
13	large patch	1	1	1	1	1	1
14	large patch	1	1	1	1	1	1
15	large patch	1	1	0	1	1	1
16	large patch	1	1	0	1	0	1
19	scattered thalli	0	1	0	0	0	1
20	large patch	0	1	0	1	0	0
21	small patch	1	1	1	1	1	1
24	small patch	1	1	1	1	0	1
25	large patch	1	1	1	1	1	1
26	large patch	1	1	1	1	1	1
27	large patch	0	1	1	1	1	1
28	large patch	1	1	1	1	1	1
29	large patch	1	1	1	1	1	1
30*	large patch	1	1	1	1	1	1
2	large patch	1	1	1	1	1	1
1	small patch	1	1	0	1	1	1
FRACTION		0.857142857	1	0.76190476	0.95238095	0.80952381	0.95238095



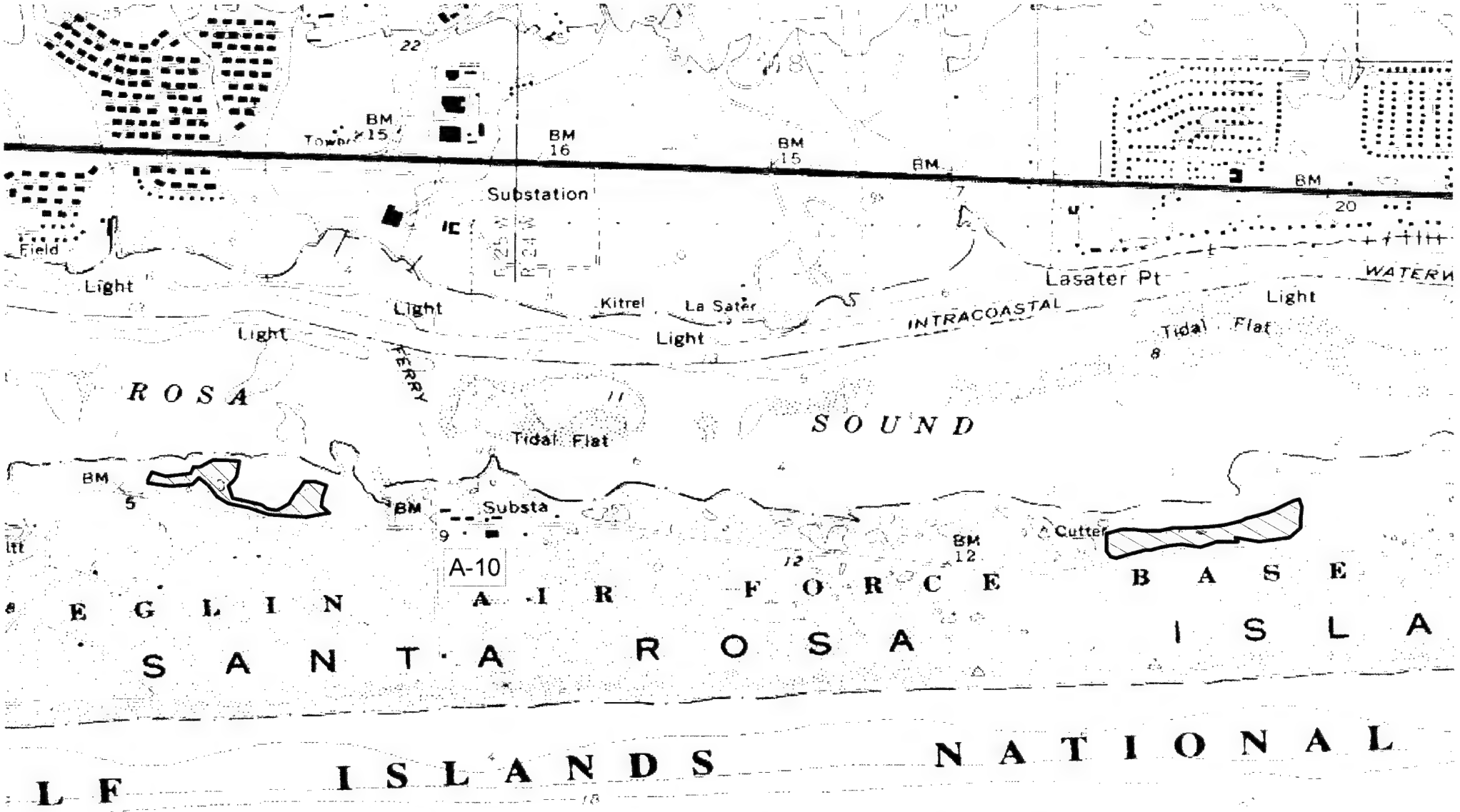
Map 1. Areas to monitor (1-5) within the current (5/00) core area occupied by perforate reindeer lichen (Cladonia perforata)



Area currently occupied by Cladonia perforata - 6/00

Area formerly occupied by Cladonia perforata

Path walked for monitoring marked points in each area



Map 2. Cladonia perforata re-introduction sites on the restricted portion of Santa Rosa Island.

Appendix E

Monitoring plan for *Matalea alabamensis*

FNAI monitoring plan for **Alabama spiny-pod** (*Matelea alabamensis*)

INTRODUCTION: Alabama spiny-pod is a herbaceous vine in the milkweed family (*Asclepidaceae*) currently known from a total of only five counties in three states: southern Georgia (Early and Wayne counties), adjacent Alabama (Henry County), and northern Florida (Walton and Liberty counties; Allison 1996). A field survey throughout its range in 1994-95 yielded plants from 23 sites[1], of which 7 are on Eglin. The roughly 2000 individuals counted on Eglin constitute far more plants (and far more vigorous plants) than were found at the rest of the sites combined (Allison 1996). Besides Eglin, the species is known from only two other protected areas: The Nature Conservancy's Apalachicola Bluffs and Ravines Preserve in Liberty County, Florida and Kolomoki Mounds State Park in Early County, Georgia. Terry Hogan, a graduate student in the Botany Department at the University of Florida, Gainesville, is scheduled to complete her masters thesis on this species in the year 2000 (tel #: 352/392-1468). Dr. Doria Gordon is her advisor (tel # 352/392-5949; email: dgordon@botany.ufl.edu).

Identification. Field identification of *Matelea alabamensis* may present a problem since the plants resemble many other vines or herbs that may co-occur in the understory (e.g. *Smilax pumila*, *Decumaria barbara*, *Hepatica*, and *Ipomoea* ssp.). Key leaf characters are the heart-shaped leaf base and opposite leaves borne on a pair of stiffly spreading leafstalks at each node. A flagged reference plant and herbarium specimens should be reviewed to acquire a clear search image before monitoring is begun each year.

Since the nine species of *Matelea* in the southeastern U.S. are nearly indistinguishable vegetatively, it is necessary to have a flower for positive identification of any new plants that may be found outside the marked monitoring areas. The only other species of *Matelea* having flower petals with dark green veins on a lighter green or yellowish background is *M. flavidula*. The distinguishing feature is the central portion of the flower, which is white in *M. alabamensis* (=the central column or gynostegium) surrounded by a yellow band (=corona), whereas the center of the flower of *M. flavidula* is yellow surrounded by a white band (Allison, 1996). The pod of *M. alabamensis* is more densely covered by pointy wart-like projections than any other species of *Matelea*, but this relative characteristic is not as useful for distinguishing the species as is the flower. To date, Florida populations of *Matelea flavidula* are known only from slope forests in Gadsden and Washington counties and the species, which is tracked by FNAI, has not been documented on Eglin.

Life history. The plant sends out trailing vines each spring from a large woody rhizome in the open understory of dry hardwood forests on the upper slopes of steephead ravines. It is associated with a canopy of sand laurel oak (*Quercus hemisphaerica*) and hickory (*Carya pallida; C. glabra*) and is absent under the denser shade of the beech/magnolia (*Fagus grandifolia/Magnolia grandiflora*) canopy found lower on the steephead slopes (Henkel 1991). Although shade tolerant, plants appear to be stimulated to flower by the opening of light gaps in the canopy. Patchy fire entering the hardwood forest from the surrounding sandhills may serve to open the canopy and stimulate flowering. When the canopy closes, plants may cease flowering, or

1 Allison's "sites" are equivalent to watersheds, rather than to FNAI occurrences.

even cease appearing vegetatively above ground for a time, only to re-appear when the canopy is opened again. Hogan (pers. comm.) observed plants re-appearing at a previously known site after a fire at Kolomoki Mounds State Park. It is not known how long the plants may survive in completely shaded situations on reserves accumulated in their large rhizomes. Another factor that appears to aid flowering is the presence of a support, such as a shrub or stump, within reach of the vines, that they can twine on and raise themselves vertically (Henkel 1991). Flowers have a foetid odor and are pollinated by flies. Fruit set may be naturally low. In four populations (N=151 plants) monitored at The Nature Conservancy's Apalachicola Bluffs and Ravines Preserve in Liberty County only 21% of the flowering plants produced fruit (Henkel 1991). This may be the result of a self-incompatibility gene locus with few alleles. Any two plants would be unable to pollinate each other unless they had different alleles at that locus, thus raising the barriers to fruit set, especially in small populations (Allison, 1996).

Populations. The twenty occurrences of *Matelea alabamensis* on Eglin in the FNAI database range from 9 to 680 individuals (Table 1). Plants are often concentrated in a small area of 50 to 100 square yards, but occasionally are scattered over half an acre. Individual vigor ranged from "feeble" - creeping along ground, to "robust" - twining on shrubs up to 20 ft off the ground. Flower abundance ranged from a few flowers per plant to many umbels per stem. At Eglin, peak flowering was observed from mid- to late May and fruiting was noted in July.

Population dynamics. Seedling, immature, and mature plants have been delineated at several sites, but the criteria used to distinguish these categories were not described. The longevity of individuals is not known. Repeat sampling of marked plants at Apalachicola Bluffs and Ravines Preserve found nearly all the plants re-appeared the second year (Gordon, 1993), an indication that numbers of individuals at a site may be fairly stable from year to year. From her field experience Hogan (pers comm, 2000) speculates that the wind-dispersed seed is widely dispersed, germinates without dormancy, and then "sits and waits" for years until an opening in the canopy stimulates flowering and fruiting. If this is the case, then known occurrences of flowering populations may naturally become vegetative and less vigorous over time as the canopy closes and new populations may appear where a treefall or fire has opened up the canopy.

Habitat The canopy trees usually mentioned as present with *M. alabamensis* include laurel oak (*Quercus hemisphaerica*), sand hickory (*Carya pallida*), sand pine (*Pinus clausa*), and southern magnolia (*Magnolia grandiflora*). The understory is often characterized as "sparse" or "open" with various grasses and shrubs listed. Soils are sandy loams or loamy sands.

POTENTIAL THREATS AND POSSIBLE MANAGEMENT RESPONSES:

- Shading. Several occurrences with small, "feeble" plants were noted in heavy shade (e.g., element occurrence numbers 10, 16, 18,) . If populations disappear or begin to seriously decrease due to shading, new surveys should be conducted for the plant in the same watershed, to see if new populations are appearing where the canopy has opened up. If so, then no action need be taken, other than marking these new populations and adding them to the number to be monitored. If no new populations are found, then selective tree

topping can be used to open canopy. Care should be taken not to disrupt the soil layer in this process. Too much thinning of canopy could favor the invasion of aggressive exotics (Chinese privet, Japanese honeysuckle) (Allison 1996). The thinned site should be monitored for invasive species and they should be removed, if they appear. An alternative to tree topping is allowing fires in the surrounding sandhills to burn into the upper slopes of the steepheads; the same precautions should be taken against invasion of exotics as in the case of thinning.

- Drought. This will naturally tend to reduce flowering even in openings (Hogan, pers. comm., 2000); continue to check flowering in subsequent normal rainfall years.
- Herbivory. Browsing by deer was mentioned only once in Eglin populations (element occurrence number 17), so this does not seem to pose a threat to reproductive output of Eglin populations. Deer are also known to eat the fruits at The Nature Conservancy's Apalachicola Bluffs and Ravines Preserve. If herbivory is noticed, check that hunting pressure on the deer herd in the area is being maintained.
- Logging. Selective logging of sand pine that has invaded the sandhills adjacent to the ravine slopes harboring the species may be planned. If so, soil disruption, sand roads, and the piles of slash should be kept away from the edge of the ravine slope, so that soil washout or an aberrantly hot fire will not affect the hardwood forest occupied by the plants.

MONITORING OBJECTIVE: Detect a substantial loss of populations (below a threshold level of 75% of original (baseline) number of occurrences =15 out of 20 sites) and, if the numbers go below this threshold, detect whether any management actions taken have halted or reversed the loss relative to the baseline number of populations.

AREAS TO MONITOR AND FREQUENCY: all 20 populations every other year (Maps 1).

- Piney Creek population - 12 occurrences (Map 2)
- Trout Creek population - 3 occurrences (Map 3)
- Hickory/Sanders Branch population - 2 occurrences (Map 4)
- Alaqua Creek tributary populations - 3 widely separated occurrences (Map 5-8)

MONITORING ACTIONS:

- Begin checking for flowers the third week in April. Schedule monitoring for estimated peak flowering time (usually mid- to late May).

- Visit 20 sites every two years. At each site walk between two permanent stakes marking the limits of the occurrence along the slope contour, noting if any plants of *M. alabamensis* are seen, and, if so, estimate whether there are 1-10, 11-100, or 101-1000 plants (see page 5 for detailed monitoring steps).

THRESHOLD FOR MANAGEMENT ACTION: If presence of spiny-pod falls below 75% of the 20 sites, determine which of the threats listed above is causing the decline and take appropriate management action.

LITERATURE CITED:

Allison, J. R. 1996. Status survey of *Matelea alabamensis* (Vail) Woodson, Alabama Spiny-pod. Prepared for the U. S. Fish and Wildlife Service under grant agreement with Georgia Dept. Of Natural Resources, Wildlife Resources Division, Georgia Natural Heritage Program, Social Circle, GA.

Gordon, D. 1993. Responses of two rare species to manipulation: effects of fire on *Matelea alabamensis* and effects of transplanting and shade on *Conradina glabra*. Unpublished final report for KOSE Grant K91SE11., The Nature Conservancy, Florida Museum of Natural History, University of Florida, Gainesville.

Henkel. T. 1991. Element stewardship abstract for *Matelea alabamensis*. The Nature Conservancy, Doria Gordon, Florida Museum of Natural History, University of Florida, Gainesville.

Hogan, T. 2000. Pers comm. Graduate student working on *Matelea alabamensis* at the University of Florida at Gainesville.

Patrick, T.S., J. R. Allison, and G.A. Krakow. 1995. Protected plants of Georgia: an information manual on plants designated by the State of Georgia as threatened, rare, or unusual. Georgia Department of Natural Resources, Wildlife Resources Division, Georgia Natural Heritage Program, Social Circle , Georgia. 218 pp.

STEPS TO SET UP MONITORING FOR *MATELEA ALABAMENSIS*: (time did not permit any field testing to be done on this on the monitoring plan).

1) Assemble materials needed:

- ½ inch PVC pipe in 4-ft lengths -- with small hole for tag drilled near tops
- numbered metal tags and wire to attach to PVC pipe
- hammer for pounding in stakes
- 4-wheel drive vehicle
- GPS unit (if available)
- topographic quadrangles -Niceville, Choctaw Beach, Portland (and aerial photos if available) of areas to be visited
- printout of portions of topographic maps showing locations (eonum) of Alabama spiny-pod occurrences (by element occurrence number) on Eglin (attached).
- printout of occurrence records, giving directions to sites and descriptions of the occurrences and habitat at site (attached).
- blank data sheets for monitoring (example attached)

1) At each site mark each end of the limits of the population along the slope contour with a 4-ft, ½ inch PVC pipe, tagged with numbered metal tag and pounded down until only 1.5 ft of PVC pipe shows above ground.

2) Take a GPS point (180 points) at one of the stakes - note number of stake GPS'd. GPS points will be used in case any stake has to be replaced.

3) Walk along slope contour between stakes and note on datasheet (see page 6) if any plants seen and if so, estimate whether the number of plants fall between are between 1 and 10, 11 and 100, or 101 and 1000 plants. Fill out date and investigator name.

4) Pencil in corrections or additions to directions given on occurrence records to aid in re-locating the stakes in the future.

5) Continue to next site and repeat.

6) Enter data from datasheets into spreadsheet (example for 3 year's data on page 7) in office computer.

SAMPLE DATASHEET

EGLIN RARE PLANT MONITORING DATASHEET								Date:
SPECIES: **Matelea alabamensis**								
								Investigator:
Site name	FNAI Occurrence number	Baseline number of plants/date	Baseline size class of population 1=1-10 2=11-100 3=101-1000	Size class noted at monitoring date 1=10 2=11-100 3=101-1000	Size class decrease? Decrease=0 No decrease = 1	Plants present? present=1 absent=0	Any plants flowering? flowering=1 not flowering=0	Notes: (plant size, herbivory, disease, soil disturbance, canopy/understory disturbance, etc.)
Trout Creek	20	50--7/94	2					
Trout Creek	21	250--7/94	3					
Trout Creek	25	100--4/96	2					
Piney Creek	6	25-- 7/92	2					
Piney Creek	9	36--5/94	2					
Piney Creek	10	44--5/94	2					
Piney Creek	11	680--5/94	3					
Piney Creek	12	181--5/94	3					
Piney Creek	13	204--5/94	3					
Piney Creek	14	9--5/94	1					
Piney Creek	15	15--5/94	2					
Piney Creek	16	17--5/94	2					
Piney Creek	17	58--5/94	2					
Piney Creek	18	116--5/94	3					
Piney Creek	19	126--5/94	3					
Hickory Branch	7	100--7/93	2					
Hickory Branch	8	67--4/94	2					
Alaqua Creek	22	40--7/95	2					
Alaqua Creek	23	30--7/95	2					
Alaqua Creek	24	20--7/95	2					

EXAMPLE OF SPREADSHEET WITH THREE YEAR'S DATA FOR MATELEA ALABAMENSIS

Eglin rare plant monitoring data - Matelea alabamensis							
FNAI Occurrence number	Baseline size class of population 1=1-10 2=11-100 3=101-1000	6/2001 P/A	6/2001 size class same or larger	6/2002 P/A	6/2002 size class same or larger	6/2003 P/A	6/2003 size class same or larger
6	2	1	1	1	0	1	0
7	2	1	1	1	1	1	0
8	2	1	1	1	1	1	1
9	2	1	1	1	1	0	0
10	2	1	0	1	1	1	1
11	3	1	1	1	1	1	1
12	3	1	1	1	1	0	0
13	3	1	1	1	1	1	1
14	1	1	1	0	0	0	0
15	2	1	1	1	1	1	0
16	2	1	1	1	1	1	0
17	2	1	1	1	1	1	1
18	3	1	0	0	1	1	1
19	3	1	1	1	1	1	1
20	2	1	1	1	1	0	0
21	3	1	1	1	1	1	1
22	2	1	1	1	1	0	0
23	2	1	1	1	1	1	1
24	2	1	1	1	1	1	1
25	2	1	1	1	1	1	1
FRACTION		1	0.9	0.9	0.9	0.75	0.55

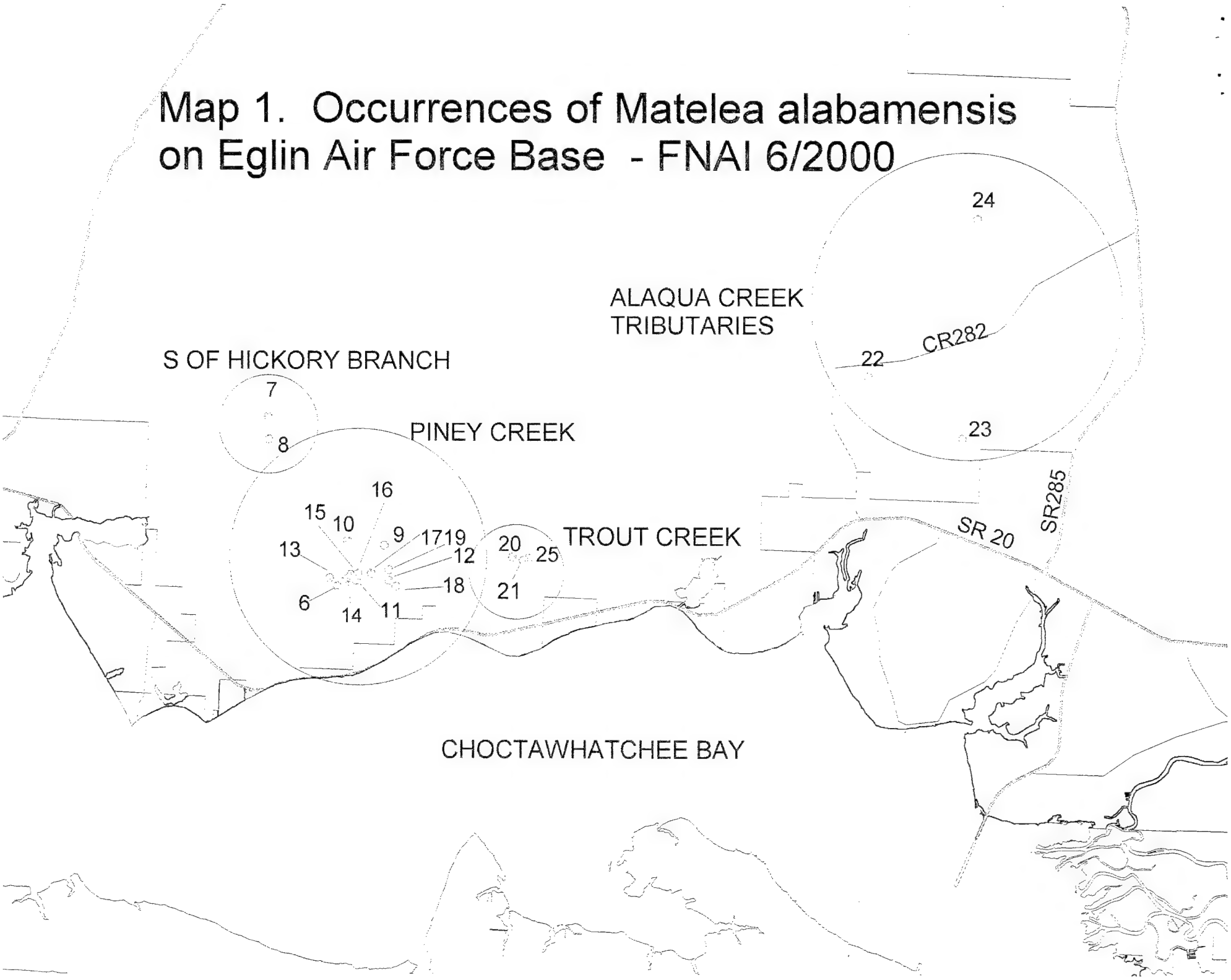
Table 1. Summary of occurrence records for ***Matelea alabamensis*** - FNAI database - 6/00

ELEMENT OCCURRENCE NUMBER	LASTOBS	DESCRIPTION	OCCURRENCE DATA	BEST SOURCE
6	1992-07-02	Hickory/Basswood Hammock on an elevated knoll near Seepage Stream.	Approx. 25 vines observed in fruit. Specimen collected.	Eilers, Richard M.
7	1994-05-19	1993-07-10: UPLAND MIXED FOREST WITH CARYA PALLIDA, TILIA CAROLINA, PINUS GLABRA, CELTIS LAEVIGATA, LAUREL OAK, ARKANSAS OAK, SAND LIVE OAK, ETC. (PNDEIL01).	1993-07-10: APPROX. 100 VINES, 10% IN FRUIT, 1 IN FLOWER AND FRUIT (PNDEIL01).	EILERS, RICHARD M.
8	1994-04-26	Matelea alabamensis grows on a south facing slope along Sanders Branch under a partially open canopy of Quercus hemisphaerica, Carya pallida, Ilex opaca, Magnolia grandiflora and Ostrya virginiana. Shrubby and herbaceous associates include Ilex coraicea,	A total of 67 plants were tabulated, 53 of which were mature, while the remaining were immature. Population occurs in a well-drained loamy sand along a south facing slope of which encompasses an area of approximately 70 square yards. Reproduction appears	Schotz, Alfred R. (Al)..
9	1994-05-30	Population occurs along a tributary of Piney Creek on a west facing slope under a partially open canopy of Quercus hemisphaerica, Carya pallida, Oxydendrum arboreum and Pinus clausa. Understory associates include Serenoa repens, Asimina parviflora, Gaylu	While only 36 plants were observed, nearly every plant is robust producing numerous flowers. Five immature plants and no seedlings were observed. Population area encompasses approximately 50 square yards along a moderate west facing slope. Despite paucit	Schotz, Alfred R. (Al).
10	1994-05-18	Population occurs along a steep, east facing slope on the North Fork of Piney Creek. Plants grow under a filtered canopy of Magnolia grandiflora, Quercus hemisphaerica, Carya pallida and Pinus clausa. Understory is quite sparse, namely composed of Carex	A total of 44 plants were counted encompassing an area of roughly 55 square yards. 29 were mature, but only producing a few flowers each. Reproduction potential can be expected to be quite low due to the minimal presence of flowers. No evidence of diseas	Schotz, Alfred R. (Al)..
11	1994-05-18	Population occurs in an upland hardwood forest community under an open to partially open canopy of Quercus hemisphaerica, Quercus arkansana, Carya pallida, Tilia caroliniana and Pinus clausa. Associate shrubs and herbs include Vitis rotundifolia, Callica	A tabulation made on May 19, 1994, disclosed 680 plants; 353 mature, 240 immature (immaturity may be attributed to excessive shading from forest canopy) and 87 seedlings. Population area encompasses about 0.5 acre along the north facing slope of Piney Cr	Schotz, Alfred R.
12	1994-05-24	Population occurs along a north facing slope of Piney Creek in an upland mixed forest composed of Quercus hemisphaerica, Quercus virginiana, Carya pallida, Magnolia grandiflora and Pinus clausa. While the understory is rather sparse throughout majority o	181 plants were tabulated, 89 mature, while the remaining are immature and in seedling stage. The population is rather well dispersed, encompassing no less than 0.5 acre along a north facing slope of Piney Creek. Reproduction potential is expected to be	Schotz, Alfred R.
13	1994-05-18	Upland hardwood forest community under an open and partially open canopy of Quercus hemisphaerica, Carya pallida, Acer saccahrum ssp. floridanum, Tilia caroliniana and Juniperus virginiana. The understory includes Vaccinium arboreum, Sebastiana fruticosa	A total of 204 plants were tabulated, 107 that were mature, while the remaining plants total 76 and 21 for immature and seedlings, respectively. Population area encompasses approximate 0.25 acre along a north facing slope of a tributary to Piney Creek (n	Schotz, Alfred R..
14	1994-05-18	This population occurs on a shallow slope under a filtered canopy of Quercus hemisphaerica, Carya pallida and Magnolia grandiflora. Understory is very sparse, only a few trailing vines of Vitis rotundifolia and depauperate specimens of Dicanthelium commu	Only nine mature plants observed, all producing a few flowers each. Population area covers approximately 45 square yards along a south facing slope on the west branch of Piney Creek, ca. 0.1 mile west of the confluence with the North Fork. Reproduction p	Schotz, Alfred R. (Al).
15	1994-05-18	Upland Hardwood Forest under a partially open canopy of Quercus hemisphaerica, Quercus virginiana, Carya pallida and Pinus clausa. Site is along an east facing slope on the North Fork of the Piney Creek.	A small population of 15 plants, 11 mature and 4 immature, were observed covering an area of approximately 40 square yards. Two plants were quite robust producing numerous flowers, while the remaining mature specimens appear feeble producing only but a f	Schotz, Alfred R. (Al).

Table 1. Summary of occurrence records for ***Matelea alabamensis*** - FNAI database - 6/00

ELEMENT OCCURRENCE NUMBER	LASTOBS	DESCRIPTION	OCCURRENCE DATA	BEST SOURCE
16	1994-05-18	Under a filtered canopy of Quercus hemisphaerica, Quercus virginiana, Oxydendrum arboreum and Carya pallida. Plants exist in an upland mixed forest community on a slope along the north side of Piney Creek.	13 mature and 4 immature plants observed Plants scattered over roughly 35 square yards. All but one plant is prostrate along the ground. No evidence of disease or predation was observed.	Schotz, Alfred R. (Al)
17	1994-05-18	Plants occur along a south facing slope on the north side of Piney Creek under a filtered canopy of Quercus hemisphaerica, Magnolia grandiflora, Ilex opaca and Oxydendrum arboreum. Shrub and herbaceous vegetation is rather sparse.	A total of 58 plants observed, 28 of which are immature. Plants are generally small and are prostrate along the ground, producing only a few flowers. Population area encompasses roughly 55 square yards along the south facing slope of Piney Creek. Few pla	Schotz, Alfred R. (Al)..
18	1994-05-24	Majority of population (few plants also on north side) occurs on a shallow northwest facing slope of a small tributary to Piney Creek. All plants occur within an upland hardwood forest community characterized by Quercus hemisphaerica, Magnolia grandiflor	116 plants observed along a small tributary of Piney Creek with a population area of approximately 80 square yards. It can be speculated that reproduction potential will be low owing to the paucity of flowers. Evidence of disease or predation was not app	Schotz, Alfred R. (Al).
19	1994-05-30	Population generally occurs along an east facing slope under a filtered to partialyl open canopy of Quercus hemisphaerica, Carya pallida, Oxydendrum arboreum, Magnolia grandiflora, Cornus florida and Pinus clausa. Understory associates include Serenoa re	Approximately 126 plants were observed, 53 with scanty flowering. Most plants are small and are prostrate along the ground. The population is rather well dispersed, encompassing an area of roughly 0.5 acre along a shallow, east facing slope of a tributar	Schotz, Alfred R. (Al). .
20	1994-07-09	1994-07-09: M. alabamensis is scattered along a rather steep, east-facing slope under a filtered canopy of Quercus hemisphaerica, Acer saccharum ssp. floridanum, Magnolia grandiflora and Tilia americana. Ground layer is rather sparse being essentially co	1994-07-09: Roughly 50 vines were tabulated climbing over vegetation. While no fruit were apparent, 29 plants appear mature based on old peduncles observed near the ends of the plants. Potential for reproduction is negligible (PNDJEN02).	Schotz, Alfred R. (Al).
21	1994-07-09	1994-07-09: Matelea inhabits well-drained soils of gentle slopes bounding both sides of a Trout Creek tributary. Plants are scattered under a filtered to partially open canopy of Pinus clausa, Carya glabra, Quercus hemisphaerica, Magnolia grandiflora, Ac	1994-07-09: Approximately 250 plants were observed, encompassing an area of about 2 acres. Although flowering has nearly ceased for this year, a few clusters were still apparent. Immature fruit were also observed. Preproduction appears good. This populat	Schotz, Alfred R. (Al). C
22	1995-07-27	A fairly steep ravine whose slopes are forested with a mixture of southern magnolia, laurel oak, sourwood, mockernut hickory and a scattering of white oak. A seepage stream banded by black titi, sweetbay, Florida anise and other baygall vegetation is sit	Approximately 35-40 plants scattered on forested slopes under a filtered canopy of Magnolia grandiflora, Quercus hemisphaerica, Carya tomentosa and Oxydendron arboreum. Only four immature pods on three plants were observed.	Schotz, Alfred R. (Al)..
23	1995-07-28	Within an upland hardwood forest dominated by laurel oak, on a tributary to Goodwin Creek. Slopes facing south, and in small north-trending steepheads along tributary.	Approximately 30 plants seen, mostly small. One large plant with two green fruit was seen; in a sunny gap.	Kindell, Carolyn.
24	1995-07-10	Very mature slope forest on the steep north-facing slopes of Alice and Alaqua Creeks. The canopy consists of tall large American beech, white oak and southern magnolia with occasional pignut hickory and spruce pine; these species are in the subcanopy as	1995-07-10: Approximately 20 plants seen, all small; no flowers or fruit seen; scattered sporadically (PNDKIN02).	Kindell, Carolyn.
25	1996-04-01	An upland hardwood forest dominated by laurel oak, southern magnolia, Florida maple, and hop hornbeam.	1996-04-01: Over 100 plants present, just coming up (about 30 cm tall). Many of these plants are vigorous with multiple stems; the point mapped is an opening dominated with spikegrass with more than 50 milkvine plants; this population may consist of seve	Nordman, Carl. C

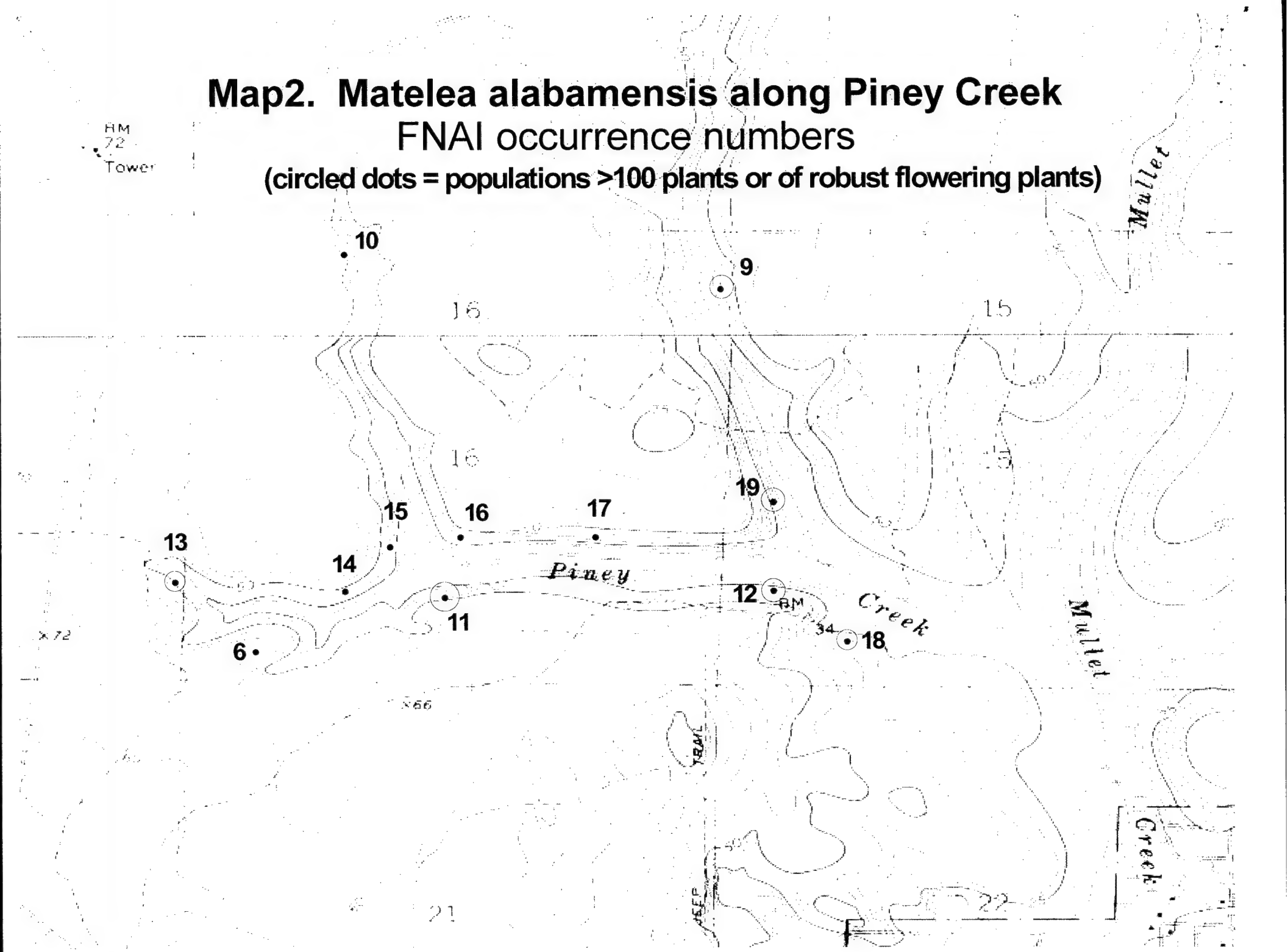
Map 1. Occurrences of Matelea alabamensis on Eglin Air Force Base - FNAI 6/2000



Map2. Matelea alabamensis along Piney Creek

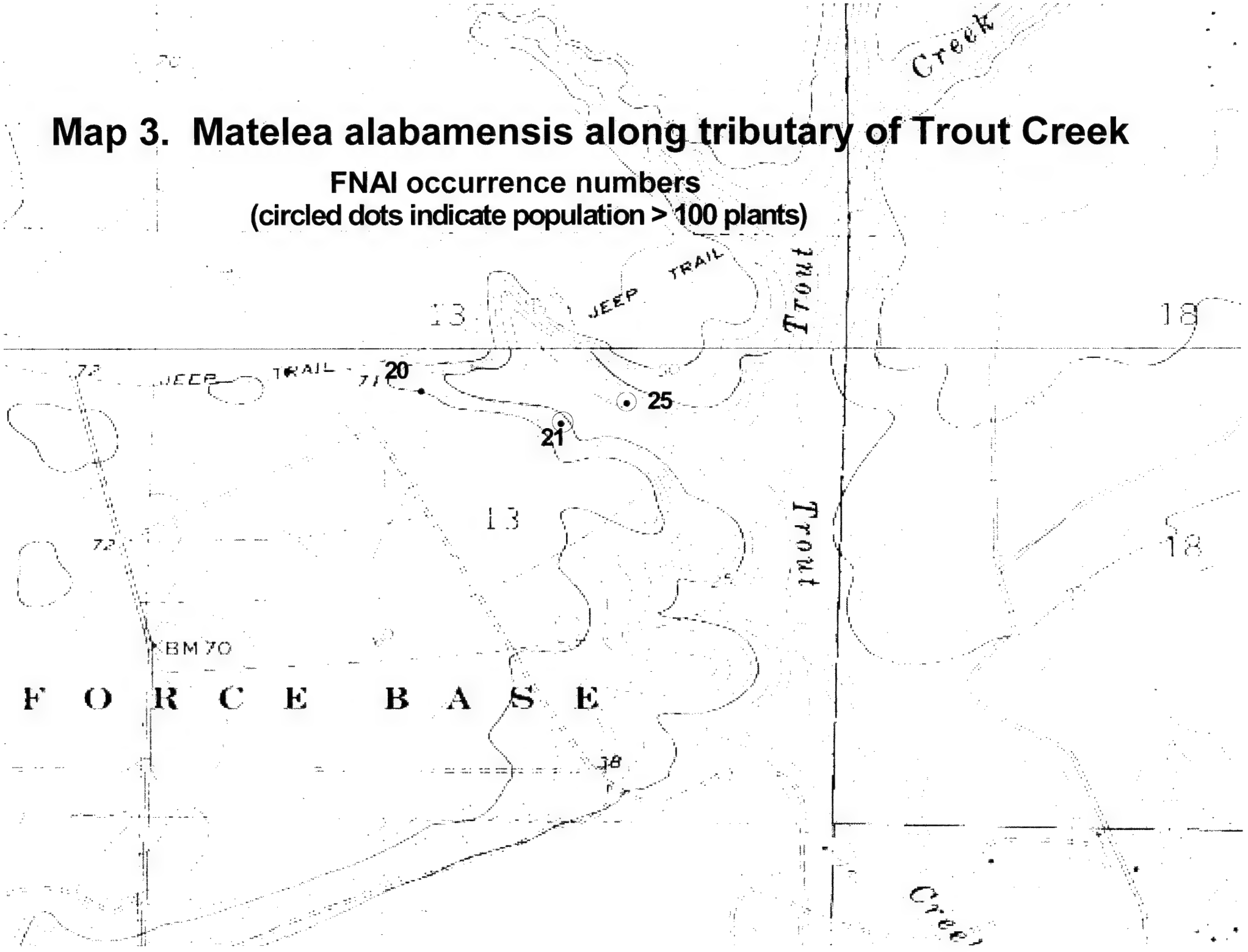
FNAI occurrence numbers

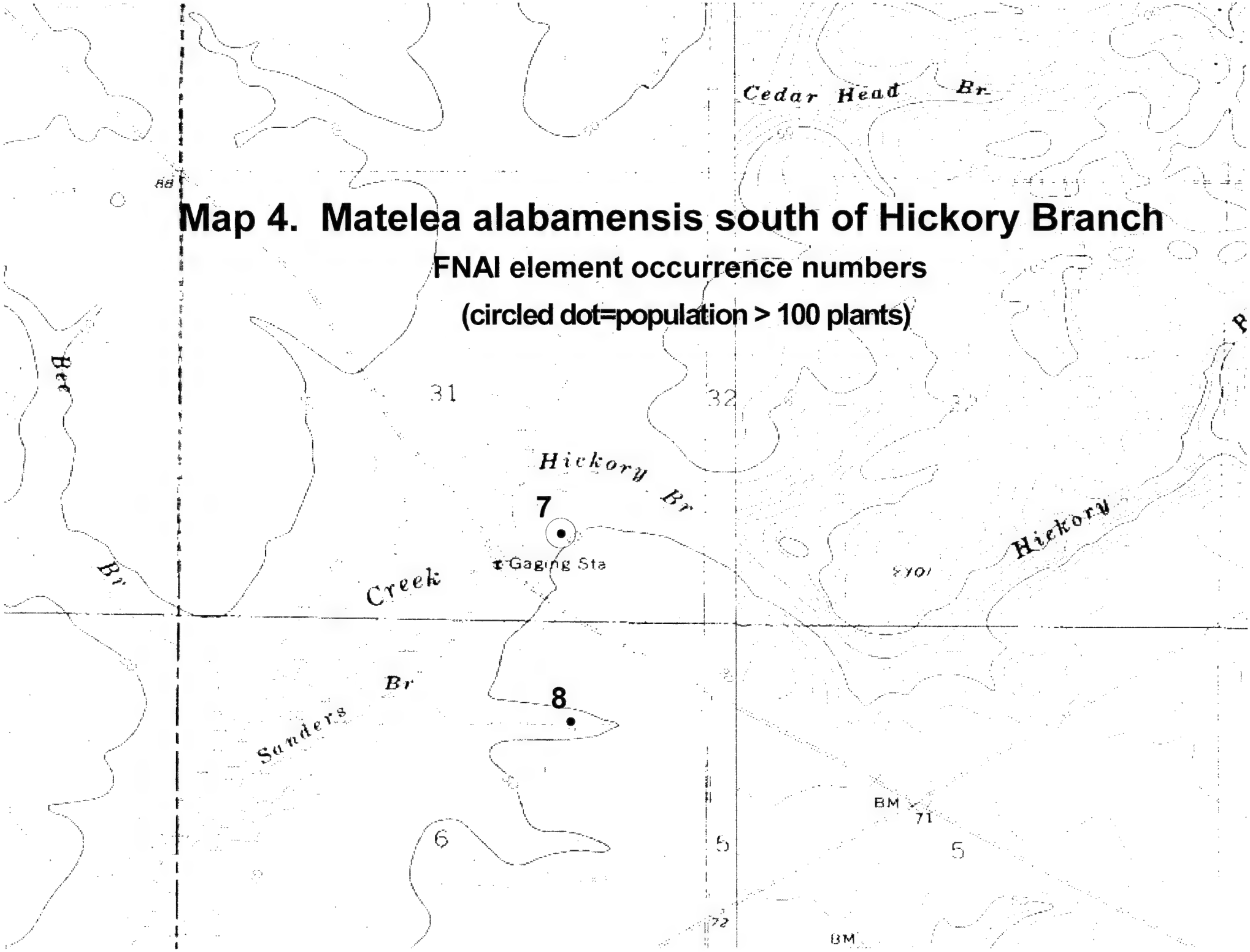
(circled dots = populations >100 plants or of robust flowering plants)



Map 3. Matelea alabamensis along tributary of Trout Creek

FNAI occurrence numbers
(circled dots indicate population > 100 plants)



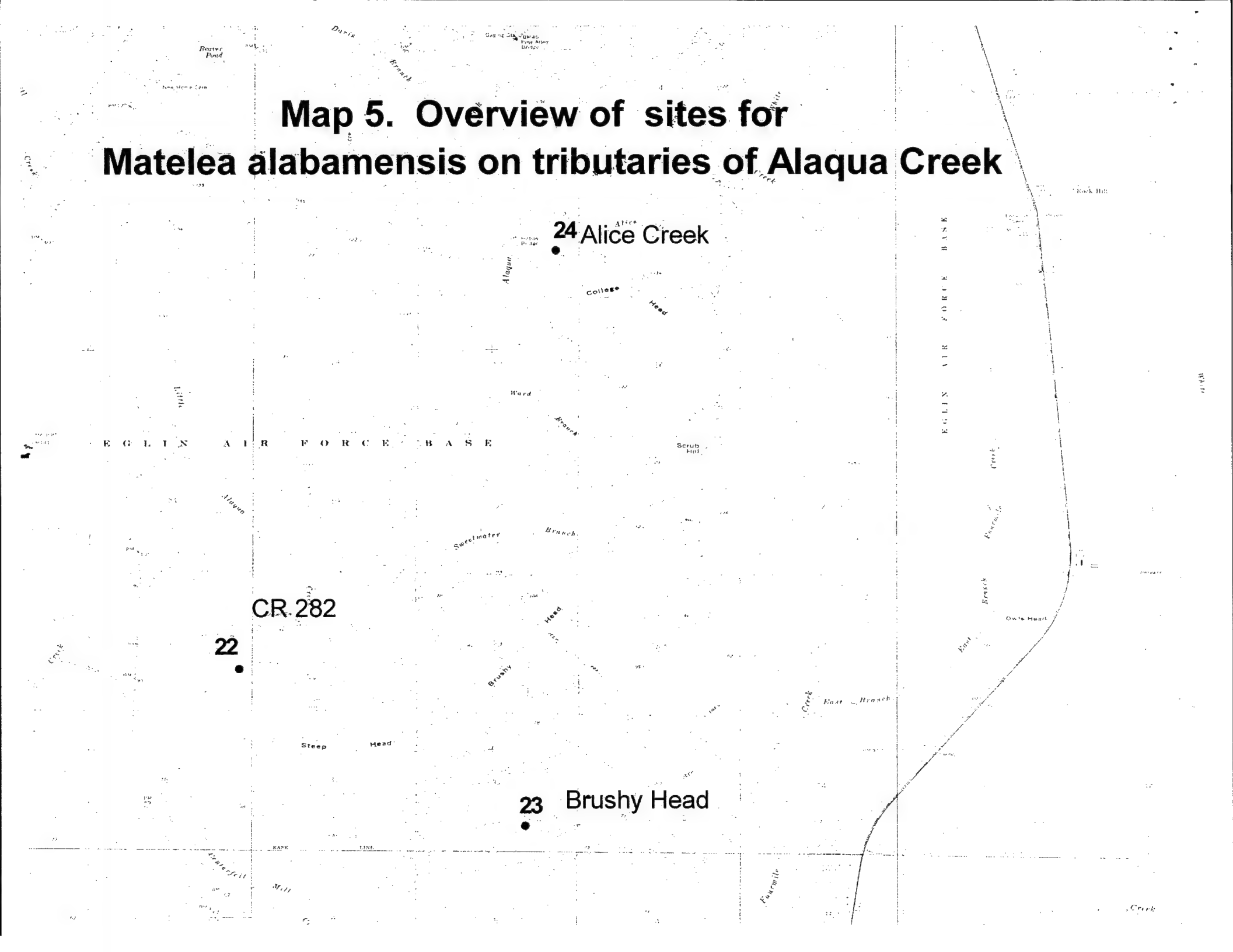


Map 4. Matelea alabamensis south of Hickory Branch

FNAI element occurrence numbers

(circled dot=population > 100 plants)

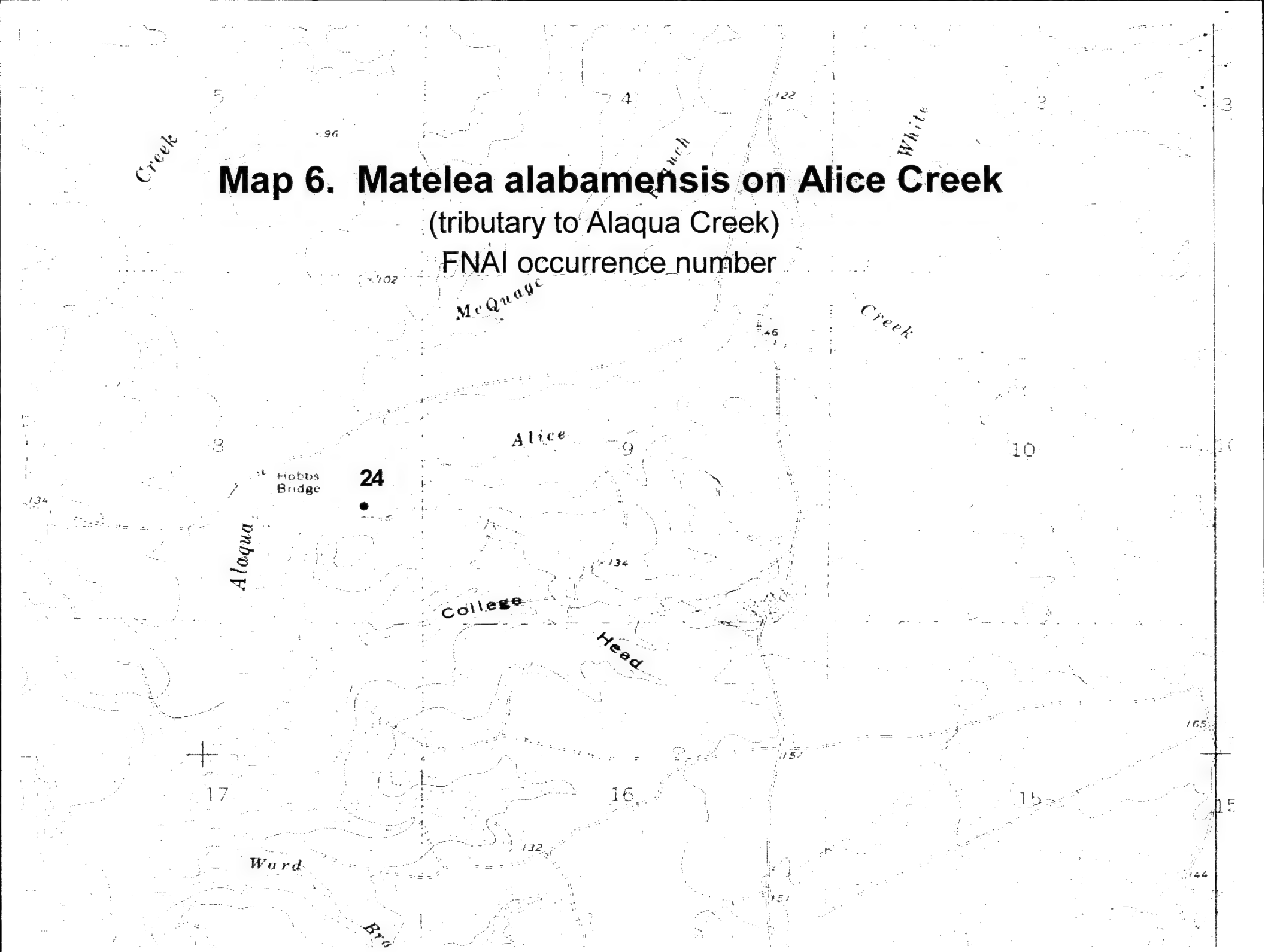
Map 5. Overview of sites for Matelea alabamensis on tributaries of Alaqua Creek



Map 6. Matelea alabamensis on Alice Creek

(tributary to Alaqua Creek)

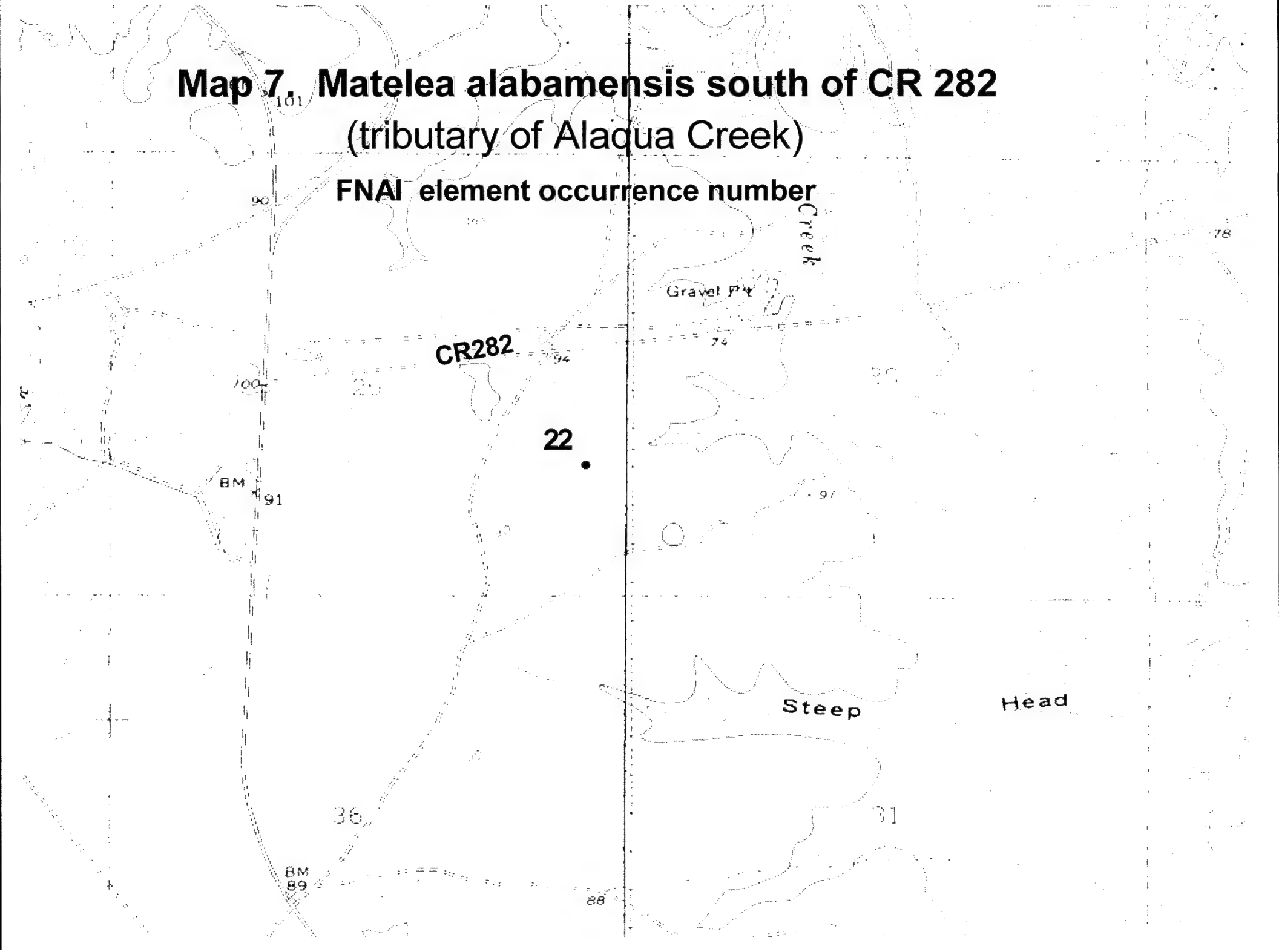
FNAI occurrence number



Map 7. Matelea alabamensis south of CR 282

(tributary of Alaqua Creek)

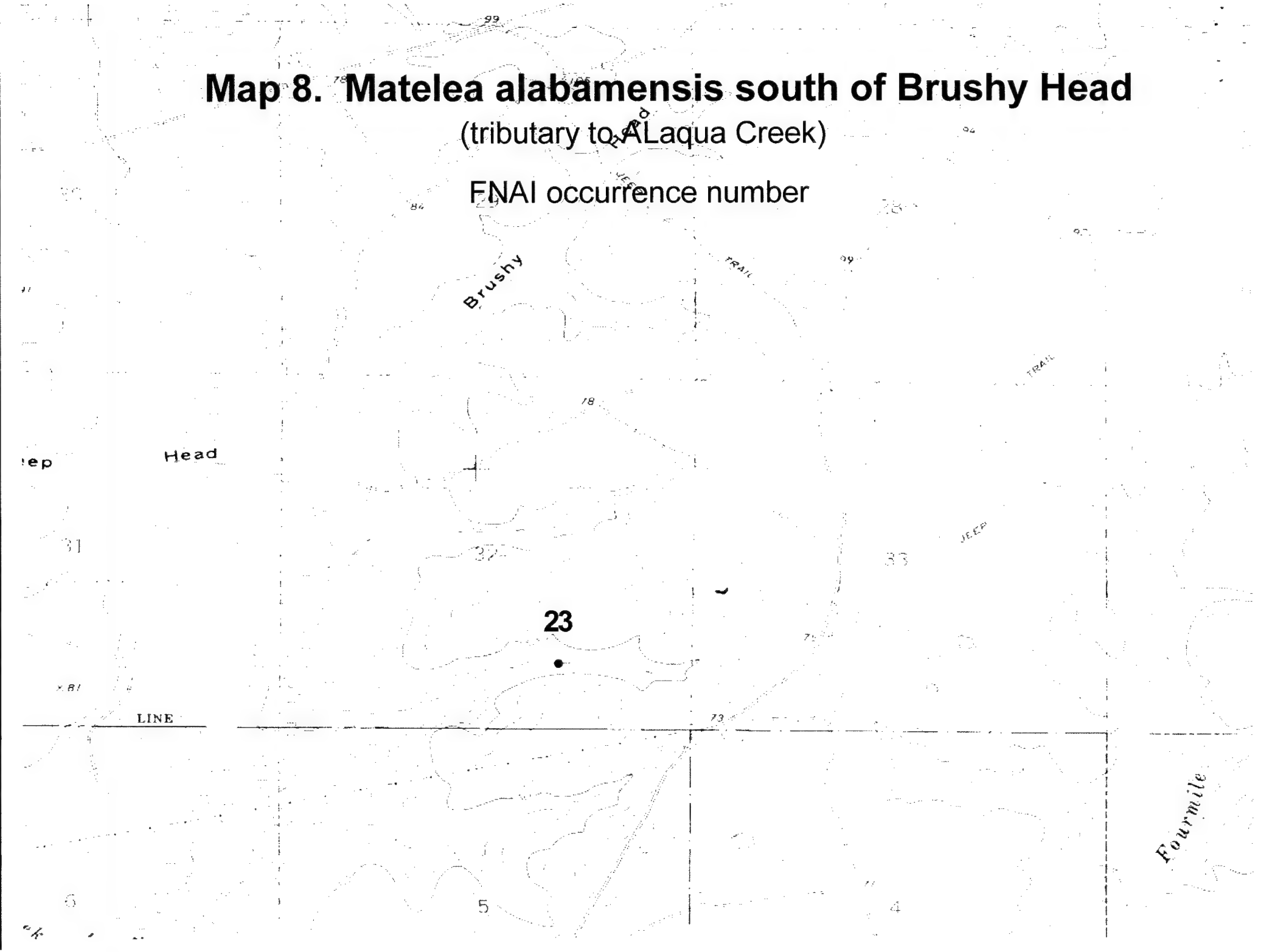
FNAI element occurrence number



Map 8. Matelea alabamensis south of Brushy Head

(tributary to ALaqua Creek)

FNAI occurrence number



3008643/57

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

OCODE: PDASC0A010*006*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: PINEY CREEK STEEPHEAD

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
FLWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
CHOCTAW BEACH	3008643	57	2,1

LAT: 302924N LONG: 0862128W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	16	TA	SW4, SW4

IRECTIONS: Eglin AFB: 1.25 mi. N of Choctaw Beach. On Eglin Range Road 218, E past T.A.D-51 (Naval Ordinance Disposal Site).

YSPROV:	WATERSHED:
L	03140102

tatus:

URVEYDATE: 1992-07-02 LASTOBS: 1992-07-02 FIRSTOBS: 1992
ORANK: EORANKDATE:
ORANKCOM:

DATA: Approx. 25 vines observed in fruit. Specimen collected.

NTACTID: CONTACT.NAME: CONTACT.NOTE:

escription:

TYPE:
NDESC: Hickory/Basswood Hammock on an elevated knoll near Seepage Stream.

NELEV: 80 MAXELEV: 90 SIZE:

rotection:

CODE:	MANAME:	MATYPE:	CONTAINED:
.USFLHP*79	EGLIN AIR FORCE BASE	FAFAB	Y

ELAND: MOREPROT: MOREMGMT: TNCINVOLVE: N
MTCOM: Keep present tree canopy intact. Protect hammock from Sandpine removal efforts in area.

OTCOM:

3008654/73

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

EOCODE: PDASC0A010*007*FL IDENT: Y
GNAME: MATELEA ALABAMENSIS
SCOMNAME: ALABAMA SPINY-POD
ELEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

NATION: US SITECODE: S.USFLHP*35
SITENAME: EGLIN AFB MEGASITE

SURVEYSITE: HICKORY BRANCH (ROCKY CREEK AND ERR 219)

PRECISION: SC

COUNTYCODE	COUNTYNAME	LOCALJURIS
FLWALT	Walton	

QUADNAME:	QUADCODE:	MARGNUM:	TENTEN:
NICEVILLE	3008654	73	10,8

LAT: 303209N LONG: 0862250W

TOWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
001N021W	31	TA	

DIRECTIONS: EGLIN AFB: FROM SR-285, TURN E ON EGLIN RANGE RD. 200 AND GO A. 1.75 MI. TURN SE ON ERR 219 FOR CA. 3 MI., CROSSING ROCKY CREEK. SITE LIES NE OF THIS POINT, S OF HICKORY BRANCH.

HYSPROV:	WATERSHED:
FL	03140102

Status:

SURVEYDATE: 1993-07-10 LASTOBS: 1994-05-19 FIRSTOBS: 1993-07-10
EORANK: EORANKDATE:
EORANKCOM:

ODATA: 1993-07-10: APPROX. 100 VINES, 10% IN FRUIT, 1 IN FLOWER AND FRUIT (PNDEIL01).

CONTACTID: CONTACT.NAME: CONTACT.NOTE:

Description:

EOTYPE:
ENDESC: 1993-07-10: UPLAND MIXED FOREST WITH CARYA PALLIDA, TILIA CAROLINA, PINUS GLABRA, CELTIS LAEVIGATA, LAUREL OAK, ARKANSAS OAK, SAND LIVE OAK, ETC. (PNDEIL01).

MINELEV: 10 MAXELEV: 50 SIZE: 5

Protection:

ACODE:	MANAME:	MATYPE:	CONTAINED:
.USFLHP*79	EGLIN AIR FORCE BASE	FAFAB	Y

FORELAND: MOREPROT: MOREMGMT: TNCINVOLVE: N
MGMTCOM:

3008654/89

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

EOCODE: PDASC0A010*008*FL IDENT: Y
SNAME: MATELEA ALABAMENSIS
SCOMNAME: ALABAMA SPINY-POD
ELEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

ROTCOM:

Ownership:

WNER: DOD: U.S. AIR FORCE OWNERINFO:

WNERCOM:

General Comments:

OMMENTS: This population of Matelea alabamensis exists in close proximity to other EOs: Carex baltzellii, Illicium floridanum and Quercus arkansana. EO size estimated at 70 square yards by A. Schotz.

Additional Topics:

DDTL.TOPICS:

OPIC KEYWORDS: UPLAND HARDWOOD FOREST

Documentation:

ATASENS: BOUNDARIES: PHOTOS:

ESTSOURCE: Schotz, Alfred R. (Al). c/o Florida Natural Areas Inventory. 1018 Thomasville Road, Suite 200-C, Tallahassee, FL 32303. (904) 224-8207.

OURCECODE: CITATION:

NDSCH05FLUS Schotz, Alfred R. (Al). Alabama Heritage Program, 64 North Union

PECIMENS:

RANSCRIBR: 94-05-27 ARS CDREV: Y

APPER: 94-07-06 ACC QC: Y

Optional Fields:

ORD.COM: OVERLAY: FNAI. MAP PROVIDED.

ONTRACT: DOD EGLIN PLANTS YR 3

IG.METHOD: DIG.DATES:

IG.COM: CODE ON BASE MAP: C001

NC.ASSOC: TNC.ASSOCCOM:

3008653/165

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

EOCODE: PDASC0A010*009*FL IDENT: Y
SNAME: MATELEA ALABAMENSIS
SCOMNAME: ALABAMA SPINY-POD
ELEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

NATION: US SITECODE: S.USFLHP*35
SITENAME: EGLIN AFB MEGASITE

SURVEYSITE: PINEY CREEK

PRECISION: SC

COUNTYCODE	COUNTYNAME	LOCALJURIS
FLWALT	Walton	

QUADNAME:	QUADCODE:	MARGNUM:	TENTEN:
NICEVILLE SE	3008653	165	3,10

LAT: 303005N LONG: 0862036W

TOWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	16,15	TA	NE4, NE4

DIRECTIONS: Eglin AFB: From the juncture of Range Roads 218 and 219 (just SW of T.A.C-52C), proceed NE on Range Road 218 ca. 0.45 mile to RR 455. Turn south onto 455 and continue ca. 1.0 mile to RR 354. Proceed west on 354 ca. 0.5 to stream. Matelea population is ca. 0.15 mile south along the east side of stream. See attached maps.

HYSPROV:	WATERSHED:
L	03140102

Status:

SURVEYDATE: 1994-05-30 LASTOBS: 1994-05-30 FIRSTOBS: 1994
SRANK: C EORANKDATE: 1994-06-08
SRANKCOM: Although population is small, nearly all plants are very robust.

SDATA: While only 36 plants were observed, nearly every plant is robust producing numerous flowers. Five immature plants and no seedlings were observed. Population area encompasses approximately 50 square yards along a moderate west facing slope. Despite paucity of seedlings, reproduction potential is expected to be high owing to the abundance of flowers.

NTACTID:	CONTACT.NAME:	CONTACT.NOTE:

Description:

TYPE:
NDESC: Population occurs along a tributary of Piney Creek on a west facing slope under a partially open canopy of Quercus hemisphaerica, Carya pallida, Oxydendrum arboreum and Pinus clausa. Understory associates include Serenoa repens, Asimina parviflora, Gaylussacia frondosa, Dichanthelium commutatum and Rhynchospora megalocarpa.

3008653/166

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

:OCODE: PDASC0A010*010*FL IDENT: Y
:NAME: MATELEA ALABAMENSIS
:COMNAME: ALABAMA SPINY-POD
:LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

:ATION: US SITECODE: S.USFLHP*35
:ITENAME: EGLIN AFB MEGASITE

:URVEYSITE: PINEY CREEK

:RECISION: SC

:OUNTYCODE	COUNTYNAME	LOCALJURIS
:LWALT	Walton	

:UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
:ICEVILLE SE	3008653	166	2,10

LAT: 303009N LONG: 0862118W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
)01S021W	16	TA	NE4, NW4

IRECTIONS: Eglin AFB: From the east side of T.A. D-51 on Range Road 218, proceed ca. 0.2 mile east to first jeep trail. Turn south on jeep trail and proceed ca. 0.2 mile to another jeep trail veering to the east. Proceed ca. 0.15 mile east to fork. Park vehicle and continue a few hundred feet to the North Fork of Piney Creek. Matelea population is about here along slope, due east of where road divides into fork. See attached maps.

HYSPROV:	WATERSHED:
:L	03140102

:tatus:

JRVEYDATE: 1994-05-18 LASTOBS: 1994-05-18 FIRSTOBS: 1994
)RANK:D EORANKDATE: 1994-06-06
)RANKCOM: Population small, plants somewhat feeble.

)DATA: A total of 44 plants were counted encompassing an area of roughly 55 square yards. 29 were mature, but only producing a few flowers each. Reproduction potential can be expected to be quite low due to the minimal presence of flowers. No evidence of disease or predation was apparent.

)NTACTID:	CONTACT.NAME:	CONTACT.NOTE:

escription:

)TYPE:
NDESC: Population occurs along a steep, east facing slope on the North Fork of Piney Creek. Plants grow under a filtered canopy of Magnolia grandiflora, Quercus hemisphaerica, Carya pallida and Pinus clausa. Understory is quite sparse, namely composed of Carex baltzellii, Chasmanthium sp., Sebastiana and Calamintha

3008643/77

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

OCODE: PDASC0A010*011*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: PINEY CREEK

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
LWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
HOCTAW BEACH	3008643	77	2,1

LAT: 302930N LONG: 0862107W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	16	TA	NE4, SE4, SW4

IRECTIONS: Eglin AFB: From the juncture of Route 20 and Water Oak St. (has sign directing to "community center") in Choctaw Beach, proceed north on Water Oak Street to end of pavement. From here make a sharp right then an immediate sharp left, proceeding to end of dirt access road at a small turnaround. Park vehicle and proceed north a few hundred feet to Piney Creek. Continue westward along Piney Creek for ca. 0.5 mile to Matelea population. See attached maps in FNAI/GMF.

HYSPROV:	WATERSHED:
L	03140102

Status:

URVEYDATE: 1994-05-04 LASTOBS: 1994-05-18 FIRSTOBS: 1994
RANK:A EORANKDATE: 1994-05-20
RANKCOM: According to Jim Alison, Georgia Dept. of Nat. Res., population is one of the two largest in the world.

DATA: A tabulation made on May 19, 1994, disclosed 680 plants; 353 mature, 240 immature (immaturity may be attributed to excessive shading from forest canopy) and 87 seedlings. Population area encompasses about 0.5 acre along the north facing slope of Piney Creek. Reproduction potential is superb owing to the abundance of flowers (and pods from last year's plants). No evidence of disease or predation observed.

NTACTID: CONTACT.NAME: CONTACT.NOTE:

Description:

TYPE:
NDESC: Population occurs in an upland hardwood forest community under an

3008643/80

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

EOCODE: PDASC0A010*012*FL IDENT: Y
SNAME: MATELEA ALABAMENSIS
SCOMNAME: ALABAMA SPINY-POD
ELEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

NATION: US SITECODE: S.USFLHP*35
SITENAME: EGLIN AFB MEGASITE

SURVEYSITE: PINEY CREEK

PRECISION: SC

COUNTYCODE	COUNTYNAME	LOCALJURIS
FLWALT	Walton	

QUADNAME:	QUADCODE:	MARGNUM:	TENTEN:
CHOCTAW BEACH	3008643	80	3,1

LAT: 302931N LONG: 0862030W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
001S021W	15	TA	SW4, SW4

DIRECTIONS: Eglin AFB: From the juncture of Route 20 and Water Oak St. (has sign directing to "community center") in Choctaw Beach, proceed north on Water Oak St. to end of pavement. From here make a sharp right turn then an immediate sharp left, proceeding to end of dirt access road at a small turnaround (distance ca. 1.5 miles from Rt. 20). Park vehicle and proceed north a few hundred feet to Piney Creek. Continue 0.2 mile east alogn Piney Creek to beginning of Matelea population. Population extends eastward several hundred feet. See attached maps in FNAI/GMF.

HYSPROV:	WATERSHED:
FL	03140102

Status:

SURVEYDATE: 1994-05-24 LASTOBS: 1994-05-24 FIRSTOBS: 1994
SRANK:B EORANKDATE: 1994-06-06
SRANKCOM: Population is healthy and in good habitat, but much smaller than largest known occurrences.

SDATA: 181 plants were tabulated, 89 mature, while the remaining are immature and in seedling stage. The population is rather well dispersed, encompassing no less than 0.5 acre along a north facing slope of Piney Creek. Reproduction potential is expected to be quite good as numerous flowers were observed on several plants. No evidence of disease or predation was apparent.

SNTACTID:	CONTACT.NAME:	CONTACT.NOTE:

Description:

STYPE:
SNDESC: Population occurs along a north facing slope of Piney Creek in an

3008643/84

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

OCODE: PDASC0A010*013*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: PINEY CREEK

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
FLWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
CHOCTAW BEACH	3008643	84	2,1

LAT: 302932N LONG: 0862137W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	17,16	TA	

IRECTIONS: Eglin AFB: Best approach is to proceed south along the east side of T.A.D-51 on RR 479 for roughly 0.8 mile. From here proceed east on poorly defined access ca. 0.15 mile to steephead. Matelea population is approximately 150 feet east along south side of stream. See attached maps in FNAI/GMF.

HYSPROV:	WATERSHED:
L	03140102

Status:

URVEYDATE: 1994-05-18 LASTOBS: 1994-05-18 FIRSTOBS: 1994
ORANK:B EORANKDATE: 1994-05-20
ORANKCOM: Healthy population, however, half as large as world's biggest occurrences.

ODATA: A total of 204 plants were tabulated, 107 that were mature, while the remaining plants total 76 and 21 for immature and seedlings, respectively. Population area encompasses approximate 0.25 acre along a north facing slope of a tributary to Piney Creek (near a steephead). Reproduction potential is excellent owing to an abundance of flowers. Last year's seed pods were observed as well. No evidence of disease or predation observed.

NTACTID:	CONTACT.NAME:	CONTACT.NOTE:

Description:

TYPE:
NDESC: Upland hardwood forest community under an open and partially open canopy of Quercus hemisphaerica, Carya pallida, Acer saccahrum ssp. floridanum, Tilia caroliniana and Juniperus virginiana. The understory includes Vaccinium arboreum, Sebastiana fruticosa,

3008643/85

Element Occurrence Record
MATELEA ALABAMENSIS

dentifiers:

OCODE: PDASC0A010*014*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

ocators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: PINEY CREEK

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
'LWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
'HOCTAW BEACH	3008643	85	2,1

LAT: 302931N LONG: 0862118W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	16	TA	NW4, SE4, SW4

IRECTIONS: Eglin AFB: From the east side of T.A. D-51 on Range Road 218, proceed ca. 0.2 mile east to first jeep trail. Turn south on jeep trail and proceed ca. 0.2 mile to another jeep trail veering to the east. Proceed ca. 0.15 mile east to fork. Park vehicle and continue a few hundred feet to the North Fork of Piney Creek. Follow Creek downstream ca. 0.8 mile to west of the confluence with the west branch of the creek. Pop. occurs on south facing slope along west branch. See attached maps.

HYSPROV:	WATERSHED:
L	03140102

tatus:

URVEYDATE: 1994-05-18 LASTOBS: 1994-05-18 FIRSTOBS: 1994
RANK:D EORANKDATE: 1994-06-05
RANKCOM: Very small feeble population.

DATA: Only nine mature plants observed, all producing a few flowers each. Population area covers approximately 45 square yards along a south facing slope on the west branch of Piney Creek, ca. 0.1 mile west of the confluence with the North Fork. Reproduction potential is sparse owing to the paucity of the flowers. No evidence of disease or predation was observed.

NTACTID:	CONTACT.NAME:	CONTACT.NOTE:

escription:

TYPE:
NDESC: This population occurs on a shallow slope under a filtered canopy of Quercus hemisphaerica, Carya pallida and Magnolia grandiflora. Understory is very sparse, only a few trailing vines of Vitis

3008643/86

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

OCODE: PDASC0A010*015*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: PINEY CREEK

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
LWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
CHOCTAW BEACH	3008643	86	2,1

LAT: 302936N LONG: 0862113W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
001S021W	16	TA	W2, SE4

IRECTIONS: Eglin AFB: From the east side of T.A. D-51 on Range Road 218, proceed ca. 0.2 mile east to first jeep trail. Turn south on jeep trail and proceed ca. 0.2 mile to another jeep trail veering to the east. Procced ca. 0.15 mile east to fork. Park vehicle and continue a few hundred feet to the North Fork of Piney Creek. Follow creek downstream ca. 0.6 mile to Matelea site. See attached maps in FNAI/GMF.

HYSPROV:	WATERSHED:
L	03140102

Status:

URVEYDATE: 1994-05-18 LASTOBS: 1994-05-18 FIRSTOBS: 1994
ORANK:D EORANKDATE: 1994-06-05
ORANKCOM: Small feeble population.

ODATA: A small population of 15 plants, 11 mature and 4 immature, were observed covering an area of approximately 40 square yards. Two plants were quite robust producing numerous flowers, while the remaining mature specimens appear feeble producing ~~only~~ but a few flowers. Reproduction potential is fair. No evidence of predation or disease was apparent.

ONTACTID: CONTACT.NAME: CONTACT.NOTE:

Description:

OTYPE:
ENDESC: Upland Hardwood Forest under a partially open canopy of Quercus hemisphaerica, Quercus virginiana, Carya pallida and Pinus clausa. Site is along an east facing slope on the North Fork of the Piney Creek.

008643/87

Element Occurrence Record
MATELEA ALABAMENSIS

dentifiers:

)CODE: PDASC0A010*016*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

ocators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: PINEY CREEK

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
LWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
HOCTAW BEACH	3008643	87	2,1

LAT: 302937N LONG: 0862105W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	16	TA	S of center

RECTIONS: Eglin AFB: From the juncture of Route 20 and Water Oak St. (has sign directing to "community center") in Choctaw Beach, proceed north on Winter Oak St. to end of pavement. From here make a sharp right turn then an immediate left, proceeding to end of dirt access road at small turnaround (distance ca. 1.5 miles from Rt. 20). Park vehicle and proceed north a few hundred feet to Piney Creek. Cross creek to north side and continue west ca. 0.4 mile to Matelea site. See attached maps in FNAI/GMF.

YSPROV:	WATERSHED:
L	03140102

tatus:

IRVEYDATE: 1994-05-18 LASTOBS: 1994-05-18 FIRSTOBS: 1994
RANK:D EORANKDATE: 1994-05-23
RANKCOM: A small, feeble population. A few robust plants exist.

DATA: 13 mature and 4 immature plants observed Plants scattered over roughly 35 square yards. All but one plant is prostrate along the ground. No evidence of disease or predation was observed.

NTACTID: CONTACT.NAME: CONTACT.NOTE:

escription:

TYPE:
NDESC: Under a filtered canopy of Quercus hemisphaerica, Quercus virginiana, Oxydendrum arboreum and Carya pallida. Plants exist in an upland mixed forest community on a slope along the north side of Piney Creek.

NELEV: 25 MAXELEV: 40 SIZE: 1

3008643/88

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

OCODE: PDASC0A010*017*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: PINEY CREEK

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
FLWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
CHOCTAW BEACH	3008643	88	3,1

LAT: 302937N LONG: 0862050W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
001S021W	16	TA	SE4

IRECTIONS: Eglin AFB: From the juncture of Route 20 and Water Oak St. (has sign directing to "community center") in Choctaw Beach, proceed north on Water Oak St. to end of pavement. From here make a sharp right turn then an immediate left proceeding to end of dirt access road at small turnaround (distance ca. 1.5 miles from Rt. 20). Park vehicle and proceed north a few hundred feet to Piney Creek. Cross creek to north side and continue west ca. 0.2 mile to Matelea population. See attached maps.

HYSPROV:	WATERSHED:
FL	03140102

Status:

URVEYDATE: 1994-05-18 LASTOBS: 1994-05-18 FIRSTOBS: 1994
ORANK: C EORANKDATE: 1994-05-23
ORANKCOM: While a few plants are robust, most are small and feeble, producing few flowers.

ODATA: A total of 58 plants observed, 28 of which are immature. Plants are generally small and are prostrate along the ground, producing only a few flowers. Population area encompasses roughly 55 square yards along the south facing slope of Piney Creek. Few plants have been browsed on by deer.

ONTACTID: CONTACT.NAME: CONTACT.NOTE:

Description:

OTYPE:
NDESC: Plants occur along a south facing slope on the north side of Piney Creek under a filtered canopy of Quercus hemisphaerica, Magnolia grandiflora, Ilex opaca and Oxydendrum arboreum. Shrub

3008643/89

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

ECODE: PDASC0A010*018*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
ELEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

NATION: US SITECODE: S.USFLHP*35
SITENAME: EGLIN AFB MEGASITE

SURVEYSITE: PINEY CREEK

PRECISION: SC

COUNTYCODE	COUNTYNAME	LOCALJURIS
FLWALT	Walton	

QUADNAME:	QUADCODE:	MARGNUM:	TENTEN:
CHOCTAW BEACH	3008643	89	3,1

LAT: 302925N LONG: 0862022W

DOWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	15	TA	SE4, SW4, SW4

DIRECTIONS: Eglin AFB: From the juncture of Route 20 and Water Oak St. (has sign directing to "community center") in Choctaw Beach, proceed north on Water Oak St. to end of pavement. From here make a sharp right turn then an immediate sharp left, proceeding to end of dirt access road at a small turnaround (distance ca. 1.5 miles from Rt. 20). Park vehicle and proceed north a few hundred feet to Piney Creek. Continue ca. 0.3 mile east along Piney Creek to small tributary (flowing west to east direction). Majority of population is along SE side of tributary. See attached maps.

ECOSPROV:	WATERSHED:
L	03140102

Status:

SURVEYDATE: 1994-05-24 LASTOBS: 1994-05-24 FIRSTOBS: 1994
GRANK: C EORANKDATE: 1994-06-06
GRANKCOM: Population much smaller than others. Only few robust plants, most producing only few flowers.

DATA: 116 plants observed along a small tributary of Piney Creek with a population area of approximately 80 square yards. It can be speculated that reproduction potential will be low owing to the paucity of flowers. Evidence of disease or predation was not apparent.

CONTACTID: CONTACT.NAME: CONTACT.NOTE:

Description:

TYPE:
NDESC: Majority of population (few plants also on north side) occurs on a shallow northwest facing slope of a small tributary to Piney

3008643/90

Element Occurrence Record
MATELEA ALABAMENSIS

dentifiers:

OCODE: PDASC0A010*019*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

ocators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: PINEY CREEK

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
LWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
HOCTAW BEACH	3008643	90	3,1

LAT: 302941N LONG: 0862030W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	15	TA	NW1/4 SW1/4

IRECTIONS: Eglin AFB: From the juncture of Route 20 and Water Oak St. (has sign directing to "community center") in Choctaw Beach, proceed north on Water Oak St. to end of pavement. From here make a sharp righ tturn then an immediate left, proceeding to end of dirt access road at small turnaround (distance ca. 1.5 miles from Rt. 20). Park vehicle and proceed north a few hundred feet to Piney Creek. Cross creek to north side and continue east, ca. 0.1 mile to confluence with large tributary flowing from the north. Pop. is ca. 300 feet north from here. See attached maps.

HYSPROV:	WATERSHED:
L	03140102

tatus:

URVEYDATE: 1994-05-30 LASTOBS: 1994-05-30 FIRSTOBS: 1994
ORANK:C EORANKDATE: 1994-06-05
ORANKCOM: Medium sized population in which most plants are small and feeble.

ODATA: Approximately 126 plants were observed, 53 with scanty flowering. Most plants are small and are prostrate along the ground. The population is rather well dispersed, encompassing an area of roughly 0.5 acre along a shallow, east facing slope of a tributary to Piney Creek. Reproduction potential wil probably be poor owing to the paucity of flowers. No evidence of predation or disease was apparent.

ONTACTID:	CONTACT.NAME:	CONTACT.NOTE:

escription:

ITYPE:

3008643/117

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

OCODE: PDASC0A010*020*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE:

RECISION: SC

COUNTYCODE	COUNTYNAME	LOCALJURIS
LWALT	Walton	

QUADNAME:	QUADCODE:	MARGNUM:	TENTEN:
CHOCTAW BEACH	3008643	117	6,1

LAT: 302956N LONG: 0861810W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	13	TA	NW1/4

IRECTIONS: Eglin AFB: From the juncture of State Route 20 and Eglin Range Road 214 (just NE of Fort Rucker Rec. Area), travel north on ERR 214 ca. 1.2 miles to powerline corridor. From here continue east along access road under powerlines for roughly 0.5 mile to creek. Matelea occurs on rim of ravine along the north side (mostly in the forest) of corridor (PNDJEN02). [Map attached to EOR in GMF/FNAI.]

HYSPROV:	WATERSHED:
L	03140102

Status:

URVEYDATE: 1994-07-09 LASTOBS: 1994-07-09 FIRSTOBS: 1994
RANK:C EORANKDATE: 1994-07-09
RANKCOM: 1994-07-09: Plants somewhat feeble. Population small compared to Piney Creek occurrences (PNDSCH05).

DATA: 1994-07-09: Roughly 50 vines were tabulated climbing over vegetation. While no fruit were apparent, 29 plants appear mature based on old peduncles observed near the ends of the plants. Potential for reproduction is negligible (PNDJEN02).

NTACTID: CONTACT.NAME: CONTACT.NOTE:

Description:

TYPE:
NDESC: 1994-07-09: M. alabamensis is scattered along a rather steep, east-facing slope under a filtered canopy of Quercus hemisphaerica, Acer saccharum ssp. floridanum, Magnolia grandiflora and Tilia americana. Ground layer is rather sparse being essentially composed of Solidago caesia, Chasmanthium laxum

3008643/118

Element Occurrence Record
MATELEA ALABAMENSIS

dentifiers:

OCODE: PDASC0A010*021*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

ocators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE:

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
LWALT	Walton	

JADNAME:	QUADCODE:	MARGNUM:	TENTEN:
HOCTAW BEACH	3008643	118	7,1

LAT: 302953N LONG: 0861758W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01S021W	13	TA	SW4, NE4

IRECTIONS: Eglin AFB: 1994-07-09: From the juncture of State Route 20 and Eglin Range Road 214 (just NE of Fort Rucker Rec. Area), travel north on ERR 214 ca. 1.2 miles to powerline corridor. From here continue east along access road under powerlines for roughly 0.5 mile to creek. Matelea inhabits hardwood forest, south of powerline corridor. Most abundant on west side of creek (PNDSCH05). [Map attached to EOR in GMF/FNAI.]

HYSPROV:	WATERSHED:
L	03140102

tatus:

URVEYDATE: 1994-07-09 LASTOBS: 1994-07-09 FIRSTOBS: 1994
RANK:B EORANKDATE: 1994-07-09
RANKCOM: 1994-07-09: Healthy plants comprise a large population. Habitat excellent (PNDSCH05).

DATA: 1994-07-09: Approximately 250 plants were observed, encompassing an area of about 2 acres. Although flowering has nearly ceased for this year, a few clusters were still apparent. Immature fruit were also observed. Preproduction appears good. This population and that representing C024 were undoubtedly contiguous prior to the installation of powerlines (PNDSCH05).

NTACTID:	CONTACT.NAME:	CONTACT.NOTE:

escription:

TYPE:
NDESC: 1994-07-09: Matelea inhabits well-drained soils of gentle slopes bounding both sides of a Trout Creek tributary. Plants are scattered under a filtered to partially open canopy of Pinus

3008652/567

Element Occurrence Record
MATELEA ALABAMENSIS

Identifiers:

OCODE: PDASC0A010*022*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

Locators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: ENCS 191

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
LWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
ORTLAND	3008652	567	5,6

LAT: 303300N LONG: 0861134W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01N020W	25	TA	

IRECTIONS: Eglin AFB: From the juncture of ERR 205 and ERR 208, proceed east on ERR 205 ca. 0.55 mile to ERR 313. Proceed south on ERR 313 for approximately 0.4 mile until a ravine comes into view on the left. Proceed east along slopes ca. 0.3 mile; Matelea is scattered along slopes. [Map attached to EOR in FNAI/GMF.]

HYSPROV:	WATERSHED:
L	03140102

Status:

URVEYDATE: 1995-07-27 LASTOBS: 1995-07-27 FIRSTOBS: 1995-07-27
ORANK: EORANKDATE:
ORANKCOM:

ODATA: Approximately 35-40 plants scattered on forested slopes under a filtered canopy of Magnolia grandiflora, Quercus hemisphaerica, Carya tomentosa and Oxydendron arboreum. Only four immature pods on three plants were observed.

ONTACTID: CONTACT.NAME: CONTACT.NOTE:

Description:

OTYPE:
ENDESC: A fairly steep ravine whose slopes are forested with a mixture of southern magnolia, laurel oak, sourwood, mockernut hickory and a scattering of white oak. A seepage stream banded by black titi, sweetbay, Florida anise and other baygall vegetation is situated on the bottom.

NELEV: 50 MAXELEV: 70 SIZE:

008652/597

Element Occurrence Record
MATELEA ALABAMENSIS

dentifiers:

DCODE: PDASC0A010*023*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

ocators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: ENCS 194, FIELD QUAD MARGIN #67

RECISION: SC

OUNTYCODE	COUNTYNAME	LOCALJURIS
LWALT	Walton	

UADNAME:	QUADCODE:	MARGNUM:	TENTEN:
ORTLAND	3008652	597	7,8

LAT: 303201N LONG: 0860948W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01N019W	32	TA	

RECTIONS: Eglin AFB: From State Highway 20 in Portland, take ERR 204 north, cross powerline R.O.W. and go 0.5 mi. to small woods road to west. Follow road 0.8 mi., then walk south to creek slope. The data collection point is approximately 200 m south of road on creek slope. [Map attached to EOR in FNAI/GMF.]

YSPROV:	WATERSHED:
L	03140102

tatus:

URVEYDATE: 1995-07-28 LASTOBS: 1995-07-28 FIRSTOBS: 1995-07-28
RANK: EORANKDATE:
RANKCOM:

DATA: Approximately 30 plants seen, mostly small. One large plant with two green fruit was seen; in a sunny gap.

NTACTID: CONTACT.NAME: CONTACT.NOTE:

escription:

TYPE:
NDESC: Within an upland hardwood forest dominated by laurel oak, on a tributary to Goodwin Creek. Slopes facing south, and in small north-trending steepheads along tributary.

NELEV: MAXELEV: SIZE:

rotection:

CODE:	MANAME:	MATYPE:	CONTAINED:
.USFLHP*79	EGLIN AIR FORCE BASE	FAFAB	Y

008652/625

Element Occurrence Record
MATELEA ALABAMENSIS

dentifiers:

OCODE: PDASC0A010*024*FL IDENT: Y
NAME: MATELEA ALABAMENSIS
COMNAME: ALABAMA SPINY-POD
LEMENT RANKS: GRANK: G2 NRANK: N2 SRANK: S2

ocators:

ATION: US SITECODE: S.USFLHP*35
ITENAME: EGLIN AFB MEGASITE

URVEYSITE: ALICE CREEK ENCS 135-UNDERBRUSH

RECISION: SC

COUNTYCODE	COUNTYNAME	LOCALJURIS
LWALT	Walton	

QUADNAME:	QUADCODE:	MARGNUM:	TENTEN:
ORTLAND	3008652	625	8,3

LAT: 303537N LONG: 0860936W

OWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
01N019W	8	TA	

IRECTIONS: Eglin AFB: Alice Creek runs east-west below Eglin Range Road 200, and to the east of Alaqua Creek; access to this area requires special permission from Eglin in addition to escort. [Map attached to EOR in FNAI/GMF.]

HYSPROV:	WATERSHED:
H	03140102

tatus:

URVEYDATE: 1995-07-10 LASTOBS: 1995-07-10 FIRSTOBS: 1995-07-10
ORANK: EORANKDATE:
ORANKCOM:

ODATA: 1995-07-10: Approximately 20 plants seen, all small; no flowers or fruit seen; scattered sporadically (PNDKIN02).

ONTACTID:	CONTACT.NAME:	CONTACT.NOTE:

escription:

OTYPE:
NDESC: Very mature slope forest on the steep north-facing slopes of Alice and Alaqua Creeks. The canopy consists of tall large American beech, white oak and southern magnolia with occasional pignut hickory and spruce pine; these species are in the subcanopy as well, along with occasional sourwood, basswood and ironwood; The shrubs are multi-layered and patchy and commonly consist of mayberry, deerberry, yaupon with occasional Kalmia latifolia and Stewartia malacodendron; Christmas fern, Baltzell's sedge and spikegrass are common herbaceous plants here, although widely scattered. Leaf litter covers the ground completely and herbs are generally sparse.

)RELAND: MOREPROT: MOREMGMT: TNCINVOLVE:
3MTCOM: Leave as is.

'OTCOM:

wnership:

/NER: DOD: USAF OWNERINFO:
/NERCOM:

eneral Comments:

)MMENTS: See Upland Hardwood Forest CTP0000000*094 for more details on habitat.

dditional Topics:

)DTL.TOPICS:

)PIC KEYWORDS: UPLAND HARDWOOD FOREST

ocumentation:

TASENS: BOUNDARIES: PHOTOS:
STSOURCE: Nordman, Carl. c/o Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, FL 32303. (904) 224-8207.

'URCECODE: CITATION:
NDNOR03FLUS Nordman, Carl. c/o Florida Natural Areas Inventory, 1018 Thomasvi

ECIMENS:

ANSCRIBR: 96-04-01 CWN CDREV: Y
PPER: 96-05-06 SAM QC: Y

ptional Fields:

)RD.COM: OVERLAY: FNAI.

NTRACT: DOD EGLIN NC YR 3

G.METHOD: DIG.DATES:
G.COM:

C.ASSOC: TNC.ASSOCCOM:

Appendix F

Explanation of FNAI/TNC, Federal, and State rarity rankings for species and communities.

RANK EXPLANATIONS

for FNAI Global Rank, FNAI State Rank, Federal Status, and State Status

The Nature Conservancy and the Natural Heritage Program Network (of which FNAI is a part) define an element as any exemplary or rare component of the natural environment, such as a species, natural community, bird rookery, spring, sinkhole, cave, or other ecological feature. An element occurrence (EO) is a single extant habitat that sustains or otherwise contributes to the survival of a population or a distinct, self-sustaining example of a particular element.

Each element (species or natural community) tracked by the Florida Natural Area Inventory (FNAI) is assigned an FNAI Global Rank based on its worldwide status, and an FNAI State Rank based on the status of the element in Florida. Element ranks are determined by many factors, the most important ones being estimated number of element occurrences, estimated abundance (number of individuals for species; area for natural communities), range, estimated adequately protected element occurrences, relative threat of destruction, and ecological fragility. The Nature Conservancy and the Natural Heritage Program Network assign the Global Ranks, and FNAI scientists assign the State Ranks. Both of these rankings are reviewed and updated as new information on the conservation status of a species or natural community becomes available.

The legal protection status information was obtained from the following sources:
Federal animal and plant listings: U.S. Fish and Wildlife Service, March 31, 1999, *Endangered and Threatened Wildlife and Plants*, 50 CFR 17.11 and 17.12.
State animal listings: Florida Game and Fresh Water Fish Commission, August 1, 1997, *Florida's Endangered Species and Species of Special Concern, Official List*
State plant listings: *Rules for the Department of Agriculture and Consumer Services, Division of Plant Industry, Chapter 5B-40, Preservation of Native Flora of Florida. Amended Oct. 5, 1998.*

FNAI GLOBAL RANK DEFINITIONS

G1	=	Critically imperiled globally because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
G2	=	Imperiled globally because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
G3	=	Either very rare and local throughout its range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction of other factors.
G4	=	apparently secure globally (may be rare in parts of range)
G5	=	demonstrably secure globally
GH	=	of historical occurrence throughout its range, may be rediscovered (e.g., ivory-billed woodpecker)
GX	=	believed to be extinct throughout range
GXC	=	extirpated from the wild but still known from captivity or cultivation
G#?	=	tentative rank (e.g., G2?)
G#G#	=	range of rank; insufficient data to assign specific global rank (e.g., G2G3)
G#T#	=	rank of a taxonomic subgroup such as a subspecies or variety; the G portion of the rank refers to the entire species and the T portion refers to the specific subgroup; numbers have same definition as above (e.g., G3T1)
G#Q	=	rank of questionable species - ranked as species but questionable whether it is species or subspecies; numbers have same definition as above (e.g., G2Q)
G#T#Q	=	same as above, but validity as subspecies or variety is questioned.
GU	=	due to lack of information, no rank or range can be assigned (e.g., GUT2).
G?	=	not yet ranked (temporary)

FNAI STATE RANK DEFINITIONS

S1	=	Critically imperiled in Florida because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
S2	=	Imperiled in Florida because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
S3	=	Either very rare and local throughout its range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction of other factors.